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Cupola Research

THE Cupola Research Committee of the American Foundrymen's Association believes it can help American foundrymen do a better job than they have been able to do in the past. This Committee was created after preliminary plans were discussed at the Cincinnati Convention in May, 1939. The Committee has a large membership of men who have been in the industry for many years. The combined foundry service of these men would total well over a thousand years.

This Committee has done considerable work in the past 32 months. One effort has been to review the technical literature concerned with the cupola, which is now being edited preparatory to publication. Another effort has been to prepare material, which, after editing, will be published as a Cupola Handbook. Some of this material will be presented at the April Convention and an effort is being made to have the Handbook available by early 1943. Another effort is to seek out unknown factors dealing with the cupola and attempt to solve these problems in research projects.

We are now attempting to raise funds to support this Committee's work involving $20,000 per annum for 5 years.

We are committed to the proposition th at your financial support will be used with good judgment and that returns to the industry will be many times its investment.

We are committed to the proposition that our efforts will be unbiased, factual, practical, directed to the man on the job and made available to the industry as promptly as possible.

Donald J. Reese

DONALD J. REESE, Chairman,
Committee on Cupola Research.

Donald J. Reese, International Nickel Co., New York City, needs little introduction to A.F.A. members. Mr. Reese has a unique record in that he has served as the first chairman of both the Chicago and Metropolitan chapters. He has addressed practically every chapter of the Association on cupola operation and has been a repeat performer on numerous occasions. He has served on various Association committees and has written extensively for the technical press. Realizing his contributions to the industry and the A.F.A., the Association, at its 45th Annual Convention, conferred upon him the J. H. Whiting Gold Medal for his contributions in the improvement of cupola melting of cast iron. The Association is fortunate to have a man who has spent many years in the study of cupola melting as Chairman, Committee on Cupola Research.

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Published by the American Foundrymen's Association, Inc., 222 West Adams St., Chicago, Ill., for the purpose of presenting Association and Chapter activities. Published monthly. Subscription price $1.00 per year. Single copies, 10c.

Entered as second class matter July 22, 1938, at the post office at Chicago, Illinois, under the Act of March 3, 1879.

Presents "Critical" Review of Patterns Submitted in 1941 Apprentice Contest

By Frank C. Cech,* Cleveland, Ohio

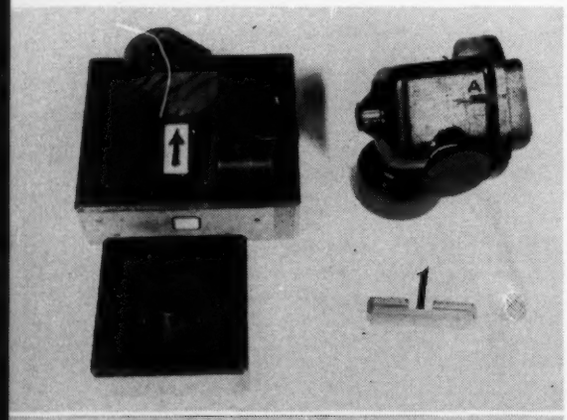
This is the third "critical" review of the patterns submitted in the Annual National Apprentice Contest and to be published in the American Foundryman. The first article appeared in the February, 1940, issue and the second in the April, 1941, edition. The resume of the 1941 pattern contest is discussed in this review and in order that a clearer conception might be had of the type of patterns submitted, the author has divided the patterns into five groups. Each of these divisions is discussed in detail, and with the aid of drawings and pictures, Mr. Cech shows how the patterns were made.

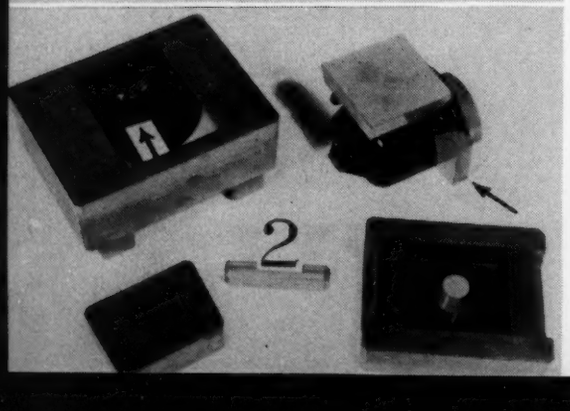
IN the February, 1940, issue of *American Foundryman* subjects of interest on apprenticeship, as considered in the past by the A.F.A. Apprentice Training Committee, were listed. One of the subjects listed, and the topic that was the basis for the article, was "Apprentice Contests in Patternmaking and Molding." In it were described the methods of conducting a pattern contest, its purpose, its judging difficulties and general comments on construction of the patterns and coreboxes submitted in the 1939 contest.

In the April, 1941, issue of *American Foundryman* a sequel to the article of February, 1940, appeared. In it were discussed such items as: The value of apprenticeship, the merits and advisability of conducting contests for apprentices, the awarding of the Northeastern Ohio Chapter A.F.A. trophies to the companies represented by the apprentice in the contest (these trophies were made by apprentices of the Cleveland Trade School), and a critical discussion of pattern entries in the 1940 contest, along with thought provoking questions raised by the construction of the contest patterns.

*Instructor, Patternmaking, Cleveland Trade School, and Vice Chairman, Patternmaking Division.

Fig. 1 (Top)—A pattern and core boxes of group 1. Fig. 2 (Bottom)—Another pattern and core boxes of group 1.





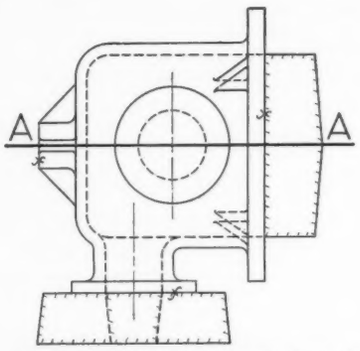


Fig. 3—Sketch illustrating method used in parting patterns of group 1.

The author of the abovementioned two resumes expressed a wish to present a review of the entries in the 1941 patternmaking contest along different lines. This article is the result of his expressed wish.

Interest in the 1941 patternmaking contest ran a record high. Some of the states represented in the competition were: Iowa, Wisconsin, Illinois, Ohio, Indiana, Rhode Island and Pennsylvania. These are the states represented by the entries submitted for review, other patterns had already been returned and were not available for description or discussion.

To further enhance the value and merits of the contests, it was decided, at the past American Foundrymen's Association convention, to box all available patterns and coreboxes entered in the contest. These containers were to be made available through A.F.A. headquarters to all A.F.A. chapters for exhibition and discussion purposes. Since the patterns and coreboxes were shipped to Cleveland Trade School for review and boxing, the Northeastern Ohio Chapter of A.F.A. was the first chapter to conduct such an exhibit, which drew much attention and produced interesting discussions and comments from the patternmakers and foundrymen present. The occasion was the annual apprentice night of the chapter, held in October, at which L. P. Robinson, one of the national directors of the A.F.A., presented to the winning apprentices the A.F.A. certificate awards, the cash awards having been previously turned over to them.

Representatives of companies, in whose employ the winning apprentices had been at the time of the contest, were honored with the Northeastern Ohio Chapter plaque trophy. An additional treat for the apprentices, of whom there were others than the winners and who had come as guests of their employers, was the talk made by Max Kuniansky, Lynchburg Foundry Co., Lynchburg, Va.

Pattern Groups

The pattern entries in the 1941 contest have been divided into five major groups for more detailed illustration and discussion.

Group 1. The first group consists of patterns split through

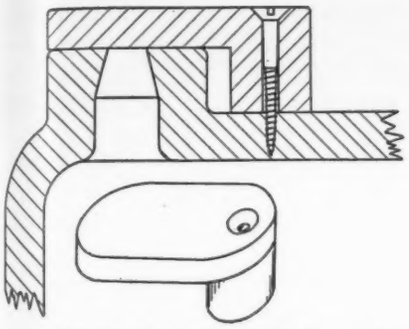


Fig. 4—Sketch illustrating method of using an eccentrically designed loose piece on bottom of core print which can be swung on a pivot to allow the operator to see how the core is drawing.

the center of the *solid* flange and having a cored flange coreprint to be set into a drag cover core, as shown in Figs. 1, 2 and 3. Of this type, there were but two entries, one each from Birdsboro, Pa., and Milwaukee, Wis. This is interesting, as it reveals a similarity of thought in two widely separated localities. The moldability of this equipment is quite practical.

The loose rib without fillets shown at A in Fig. 1 will produce a rough looking casting. The writer is not in favor of a drag cover core, shown at lower right in Fig. 2, because of the possibility of a drop into the impression left by the flange, due to insufficient support for the core. This might result in sand holes or similar defects, especially as the only seating for the core is what little is formed by the narrow rim of coreprint.

The arrow in Fig. 1 calls attention to the loose piece in the corebox, the sole purpose of which seems to be to facilitate dumping the core by drawing back the piece after the core is dumped, thus preventing damage to the core. This provision should not be necessary in a corebox of this type. A square, instead of a round, core print is shown in Fig. 2, which is an improvement over the preceding job, insofar as the increased seating area will resist the ramming force.

The arrow placed within the corebox points to a deep pocket. The draw of this part of the core could be improved by letting the bottom open but permitting temporary closing by an eccentrically designed loose piece fastened by and pivoting on a screw, as shown in Fig. 4. This would permit the loose piece to be swung out of the way to witness either the successful draw or the start of a possible breaking of the core, which might be prevented if seen. The arrow (Fig. 2) pointing out the slab core print again calls attention to the recurrent absence of draft on the core print sides.

Group 2. The second group consists of patterns split through the center of the *cored* flange, having one-half of flange core print set in drag and the other half in the cope, as represented in Fig. 5 and illustrated in Fig. 6. The choice of this method of molding was rather broad as localities represented included Cleveland, Ohio; Providence, R. I.; Oshkosh, Wis.; East Chicago, Ind.; and Milwaukee, Wis.

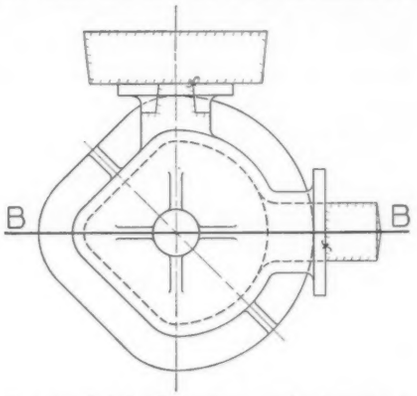


Fig. 5—Sketch illustrating method used to make patterns which are split through the center of a cored flange.

The method of molding represented by this type of pattern equipment is preferred, not only because it is practical, but in addition it leaves no fins or marks due to mismatched cores or mismatched joints of cores and adjacent green sand walls.

Note the arrow pointing to brass dowels on one of the equipments for booking the core halves, should the foundry so desire. This is a feature of pattern work that always can be more easily removed than added. Two methods of doweling the cover core to the remainder of the pattern are shown in Fig. 15. The center dowel, turned as an integral part of the pipe section of the pattern, not only will locate the flange and cover core in place, but also will act as a support for the cover core while ramming over the top. A cover core used in the cope presents less chance for a drop than a cover core used in the drag.

Group 3. The third group of patterns consists of those so made that all of the job is cast in the drag. The main core is set with the aid of a cover core, always a popular molding method, and when accurately made, an effective one. This method of molding is shown in the sketch in Fig. 7 and is illustrated in Figs. 8, 9 and 10. This method was chosen by more contestants than any other. A cast-

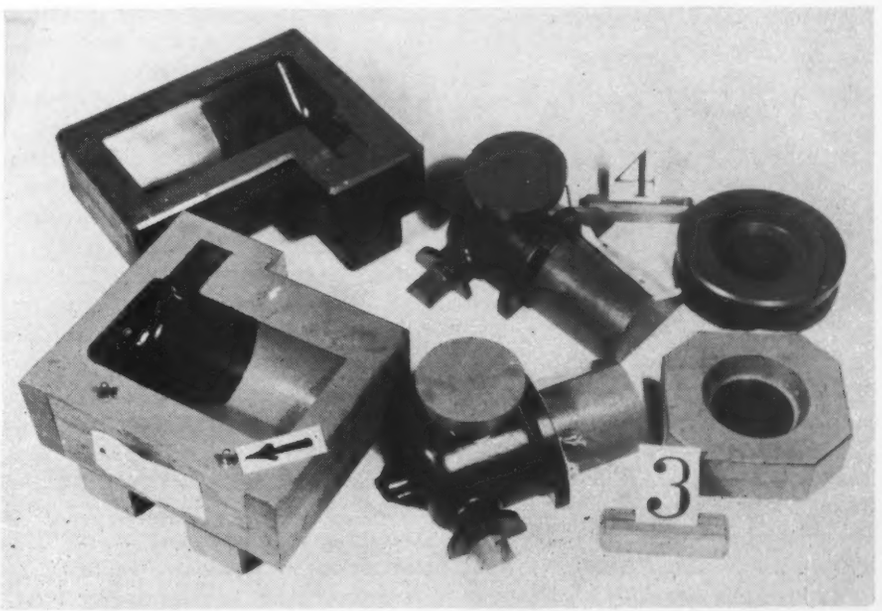


Fig. 6—Two patterns with their respective core boxes made in accordance with the method illustrated in Fig. 5.

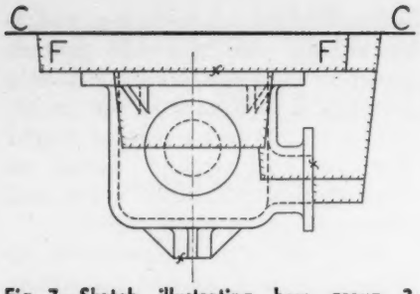
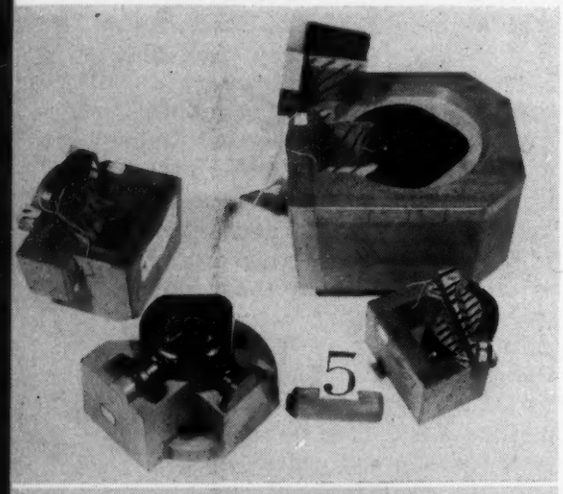
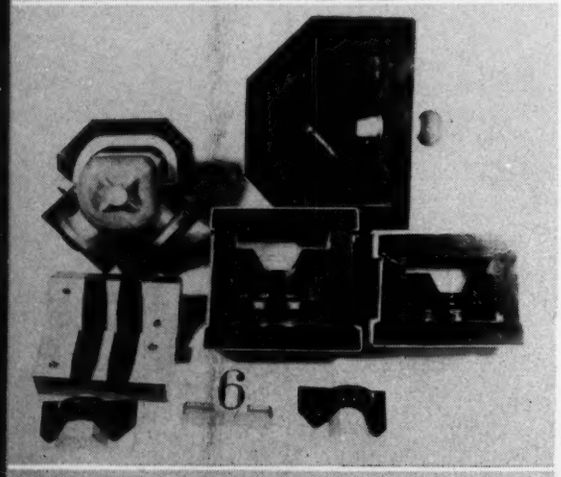


Fig. 7—Sketch illustrating how group 3 patterns are made. These patterns and core boxes are made in such a manner that the entire job is cast in the drag.

ing made by this method is likely to have more fins to remove and more uneven wall thickness due to miss-matched surfaces brought about by inaccuracies of the equipment made in the pattern shop and distorted in the coreroom and foundry or in setting and aligning the cores. In other words, setting cores makes it necessary to: First, match green sand surfaces with the surfaces of dry sand cores, and second, match interlocking or overlapping cores or surfaces. The possibility of fins and offset surfaces increases as the pattern equipment becomes worn, thereby increasing the cleaning costs and decreasing the pleasing appearance, a necessity on some types of casting.

Fig. 8 (Top)—A pattern and core boxes classified in group 3. Fig. 9 (Center)—Another pattern of group 3. Fig. 10 (Bottom)—A third pattern classified in group 3.





In Fig. 8 the large corebox contains the flange core, one-half of which is made by the loose piece that, when removed, provides a bed-in for green sand to support the flange core while drying. The construction of the corebox to the left of the pattern is preferred to that of the corebox to the right, as the green sand used to bank the core at the right will tumble away when corebox is rolled, unless a bed-in frame is added.

In Fig. 9 the plug coreprint, shown in position in the large corebox, is used to provide a seat for the pin core, the corebox for which is seen to its left and below the pattern. It presents a practical method of providing coreprints, especially those types which, because of radial or angle seating are back draft, cannot be drawn. To prevent a drop, the impression should be filled with green sand. The method of construction of the loose pieces, and their seating, is commendable, the workmanship excellent, but why use wax fillets around the boss when leather fillets are used around flange. The use of wax fillets is inconsistent with the excellent workmanship of this pattern and coreboxes and the time saved in their use is negligible. The use of natural color shellac for the body of the pattern reveals the workmanship and has been suggested as a change for the A.F.A. pattern color standards for this reason.

The discussion regarding the patterns shown in Figs. 8 and 9 applies to some of the pattern equipment shown in Fig. 10. The construction of the large corebox would be ideal, were it not for the flange core that, on drawing away the corebox halves from the core, will be left suspended in mid air with no support. The possibility of a drop, strain, crack, or sagging core, with the additional care necessary in handling green cores of this type, are arguments against this construction.

Group 4. The fourth group of pattern equipment, illustrated by Figs. 11 and 12, is well constructed, of excellent workmanship and adapted to heavy production; made in a dry sand or cored drag and green sand cope. This pattern equipment, as well as the one that follows, represents a special type of molding and coring common only to the motor, diesel, aircraft, and similar work, that requires a high degree of accuracy. As this pattern is now made, it is necessary to set it on the bottom board, solid boss down, and ram up the drag. After it is rolled the molder must provide an offset cope parting along lines *"DD,"* Fig. 11 (which is conducive to more work and a poorer casting), and then continue with the ramming of the cope. To improve the moldability of this pattern, it is but necessary to make the green sand half loose. The parting will run through D-D. The cope half will include that part of the main core that lies below the flange core which must be drafted to draw from the cope, the draft acting as a shaving or crushing strip in closing the cope over the drag core, thus avoiding a mean cope lift. The double line shown on the drag print in Fig. 11 represents a taper put on the corebox ends to facilitate the dumping of the core. This is an unusual feature as drag cores always set better on a straight surface. The loose ring in the corebox would serve

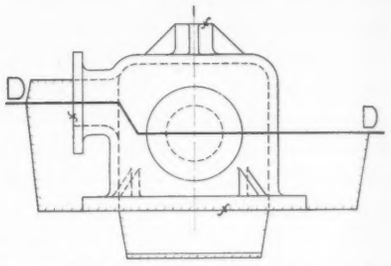


Fig. 11—Sketch showing method used for making patterns of group 4.

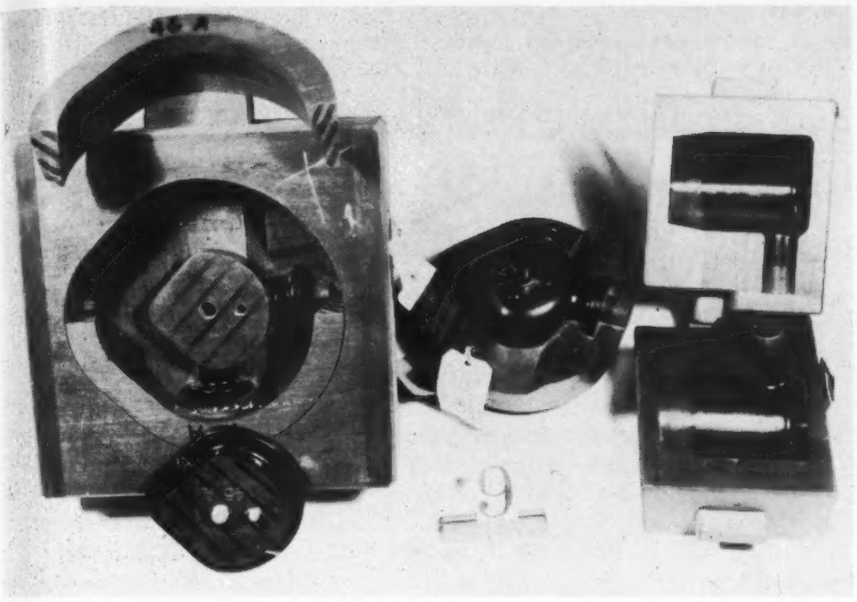


Fig. 12—Pattern constructed with parting line as illustrated in Fig. 11.

better if made in three or four pieces, as this would counteract the closing or opening of the ends due to short grain, changing shape more easily when exposed to moisture. Note the handles provided for an easy draw.

Group 5. The fifth group of pattern equipment, referred to in the last classification and represented in Figs. 13 and 14, is composed entirely of cores. It is a class of molding used on patterns for precision castings made on a quantity basis where a fine degree of accuracy and fast, highly-productive foundry methods are used. The loose pieces or corebox rails are used to compensate for the back-draft made necessary because of the manner in which the pattern is molded. Making the offset parting in the large coreboxes on an angle or with heavy draft rather than straight, would facilitate the removal of the cores from the coreboxes.

When closely scrutinized the loose piece for the flange section of the casting may be seen to include the ribs and fillets, thereby reducing the number of loose pieces used. The marking of the core numbers could be improved by using the running order of numbers to conform with the logical core setting sequence. This is a commendable feature in the making of the pattern equipment. An equipment such as this is good for hundreds of castings and would hardly be warranted by an order for 40 castings, which the contest blueprint called for.

Figure 15 shows a common corebox construction fault

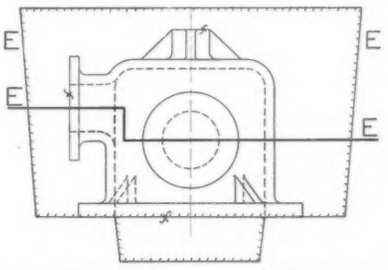


Fig. 13—Sketch showing method proposed by patterns of group 5. Such patterns provide that the mold be made entirely of cores.

(pointed to by the arrow), that of a deep, narrow and blind draw. This could be eliminated by having the end board loose on dowels and held temporarily in place by dogs, a clamp, or hooks.

Notice also the end grain exposed at the top of the corebox and to the left of the arrow. The difference in lumber shrinkage between that across the face of a board and that in length, makes this construction undesirable as the top of the corebox may become uneven and prevent an even strike-off in making the core.

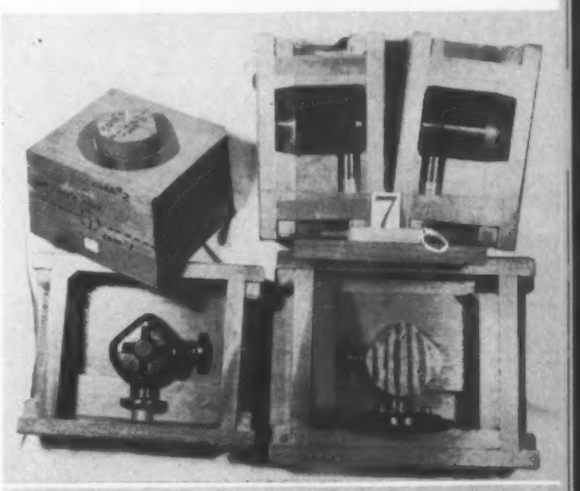
Conclusion

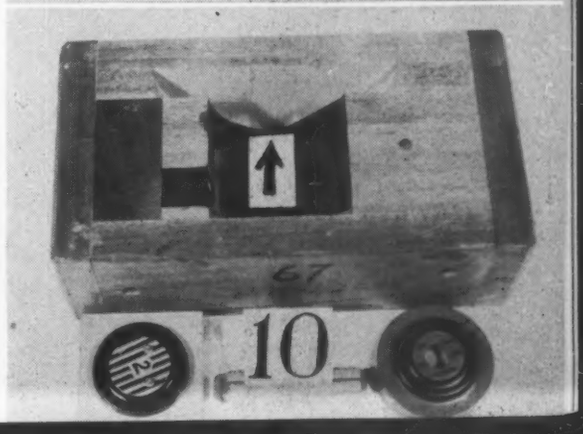
In conclusion, it is necessary to add some comments on the manner in which this review has been made.

This review has been made from a critical angle. This being the case, it is only fair to the contestants to add that many patterns and coreboxes submitted in this contest were of excellent construction, of high grade workmanship and beautifully finished. The question naturally arises. "Why did not this or that pattern win the contest?" In judging, the following were considered: Moldability, accuracy, quality workmanship, time and average rating of a number of judges, some of whom rate high and some low. From this it may be seen that the average rating may be raised or lowered by the contestant standing exceptionally high or low in a particular phase of the judging.

In striving to reach perfection, it is the teacher's or judge's irony of fate to forever point out and criticise the shortcomings of the individual, be he apprentice or journeyman. There are many young men finishing their indenture as apprentices who have an almost uncanny sense of planning a job and manipulative skill, to such an extent in fact that many disbelieve that an apprentice has made the pattern and coreboxes. The display of thought given to the contest pat-

Fig. 14 (Top)—Pattern equipment for making job all in cores and Fig. 15 (Bottom) —A common core box construction fault.





terns has been refreshing as it reveals that the love of craftsmanship is not dead even in a land where production is the byword. An apprentice's lot is not easy, but the reward reaped in a later acquired satisfaction of knowing and doing is the success yearned for by all.

We Are in It!

FIRE is a peculiar thing. In early civilizations it was worshipped as God. Later, it was thought to be a chemical element. It is a paradox. If controlled, it adds to our comfort; uncontrolled, it is a destroyer.

For over two years the world has been on fire with the United States as a spectator who lent a hand in trying to confine the conflagration to a limited area. On December 7 the fire got out of control and engulfed us. We must now assume the role of fireman and put out the flames.

Did you ever notice how, as soon as a fire is discovered, everyone pitches in to help? Each person cooperates with the other in his endeavor to save life and property. That might be said to be the attribute of fire—it promotes cooperative action. In last month's editorial we drew a parallel between the experiences of British and American foundries and foundrymen and their organizations, both trade and technical. We advanced the suggestion that an Over-all Castings Industry Committee of foundry associations and societies be formed to give the foundry industry a united front so that it could render maximum assistance to the government in the National Defense Program. Of course, times have changed. Our National Defense Program has overnight become a program of both defense and offense. We are in the war to WIN and must have a decisive VICTORY if all those principles that we hold dear are to remain with us. We are fighting for our National Life and mode of living.

To win through to final and complete Victory, we must cooperate as we have never cooperated before—individually, collectively and particularly industrially. For this war will be fought as much on the production line as in the field. Here is where an Over-all Castings Industry Committee could function. Such a committee would impress the government and its representatives with the important part that the castings industry plays in supplying parts for machinery to manufacture necessary field equipment and its contributions directly to the maintenance of our field forces. It could also deal with problems concerning the industry, irrespective of their specific division interests, which must be taken up with the government in connection with war production. It could be a body to speak for the industry as a whole. It could lay the groundwork for resumption of normal business when the war is over with the hope that the cessation of hostilities will not mean the recurrence of what happened after the last war. In fact, grave responsibilities would be on its shoulders.

Normally, the four major branches of the foundry are competitive with one another. To some extent, this competition will exist throughout the present war. However, what we require most is production and it may be that, to secure this, it will be necessary to manufacture certain castings from types of metal which heretofore had not been used for them. Here again, this Over-all Committee could suggest that certain castings or parts, if required in too great quantities for one particular branch to produce within an allotted time, be made of other metals by other branches of the industry and, in this way, secure the necessary production.

You will be interested to know that steps already have been taken to form such a committee. On December 8 a group of executives from the various foundry trade and technical associations and societies met in Cleveland to discuss the formation of such an Over-all Committee. The group expects to meet again soon for further discussion of plans. We congratulate the various organizations participating in the conference on their broad viewpoint and hope that the results of these meetings will lead to unity and cooperation among the members of these organizations.

Book Review

Foundry Practice, **by C. E. Schubert; published by John S. Swift Co., Inc., St. Louis, Mo.; paper cover with spiral binding; containing 142 pages and 68 illustrations; price $1.70, University Book Store, 202 S. Mathews, Urbana, Ill. This manual of foundry practice explains and gives the engineering student an elementary and fundamental knowledge of the principles of bench molding, machine molding, bench core making, machine core making, non-ferrous molding and melting practices, metallurgy of both ordinary cast iron and alloy cast iron, operation of the cupola, calculation of cupola charges, physical testing of cast iron, and a conception of the physical properties of core sands and molding sands. Most of this theoretical knowledge imparted to engineering students will help them dispel, in whole or in part, some of the ancient "myths" of various metals that some older engineers possess and give the younger engineers a more scientific background for the solution of the casting and engineering problems of today. As a text book used for the teaching of elementary foundry principles, the material within this book is easily understood and interestingly presented.**

War Efforts and Problems to Be Theme of First Western Hemisphere Foundry Congress

PREVIOUS to the declaration of war by the Axis countries, the A.F.A. Board of Directors, recognizing the trend of world events, had authorized broadening the scope of the Annual Convention set for Cleveland, April 20 to 24, 1942, to cover the foundry interest of all countries in North, Central and South America. Aware of the increasing attention given by Central and South American foundries to the work of the A.F.A., and the accelerating importance of foundry work in all the Americas, the Board designated the 1942 convention as "The First Western Hemisphere Foundry Congress," inviting attendance of all foundrymen of this hemisphere, with the Canadian and U. S. A. members as hosts. With the declaration of war, it is realized that the convention will now, more than ever, be needed to bring foundrymen together to discuss the major foundry problems involved in war production in which the industry will play such an important part in providing equipment for mechanized warfare.

Major Foundry Show

In connection with the congress, a major Foundry Show will be staged with particular attention given to war production efforts on the part of foundrymen. Government departments and the Army Ordnance Association, with some large industrial organizations, are backing a "Special War Materials Exhibit," a major feature of the Foundry Show to be held in the Cleveland exhibit building. Ordnance material to be displayed will be arranged to show possibilities of parts to be produced as castings. Advance reservations from foundry equipment and supply firms for space indicate that the Show will be outstanding as compared to any of recent years, with space requirements taxing the capacity of the Exhibition Hall, one of the largest in the country.

Congress Sessions to Cover Wide Range of Topics

The sessions for the congress are being planned by a large number of committees of the Association. As in the Show, attention is directed to war production problems facing the nation and industry. Altogether, some 50 sessions are being arranged for the convention days with all branches of the industry represented and provision made to discuss the problems of the manager, metallurgist, engineer and shopman in each branch.

The program committees have developed a schedule of sessions which will make the week's meeting one of the most valuable in the Association's history.

Management Sessions

Management problems of foundry operations as affected by war effort will be stressed through sessions on training personnel, foundry cost methods, safety and hygiene, plant and plant equipment and job evaluation and time study. In addition, each day special talks will be given on subjects relating to special problems by outstanding men from the government departments. These special meetings will be a feature of the convention and will bring to those attending the latest developments of the National Program as they affect the foundry industry.

Metallurgical Sessions

Metallurgical developments will be stressed in some fifteen sessions, these being apportioned between the steel castings, gray iron castings, malleable iron castings and non-ferrous divisions. Already an imposing list of noted foundry metallurgists have been scheduled for papers.

Symposium on Graphitization

The malleable division feature will be a symposium on graphitization. Carl Joseph, Saginaw Malleable Iron Div., General Motors Corp., chairman of the malleable division program committee, has arranged with Dr. Harry A. Schwartz, National Malleable & Steel Castings Co., Cleveland, to lead the symposium. Other contributions will be made by Dr. Richard Schnei-

Cleveland night scene with the illuminated Terminal Tower Building in the background.

dewind, University of Michigan; R. J. Anderson, Belle City Malleable Iron Co., Racine, Wis.; W. D. McMillan, International Harvester Co., Chicago; W. R. Bean, Whiting Corp., Harvey, Ill.; R. J. Cowan, Surface Combustion Co., Toledo, Ohio; A. L. Boegehold, General Motors Research Lab., Detroit, Mich.; D. P. Forbes, Gunite Foundries Corp., Rockford, Ill.; and R. M. Cherry, General Electric Co., Schenectady, N. Y.

Shop Courses

Two shop courses offering fundamental instruction to plant men are scheduled. The first of these, under the Sand Shop Course Committee, with E. E. Woodliff, Harry W. Dietert Co., Detroit, as chairman, will present four sessions on "Fundamentals of Sand Control," the leader of the meetings being W. G. Reichert, American Brake Shoe & Foundry Co., Mahwah, N. J. These sessions will be designed for the benefit of the younger men of the industry interested in knowing how to carry on sand control in those shops where such control has not been exercised.

The Gray Iron Shop Course Committee, under the chairmanship of K. H. Priestley, Eaton-Erb Foundry Div., Eaton Mfg. Co., Vassar, Mich., is to sponsor four sessions on Shrinkage of Cast Iron, dealing with the fundamentals as they apply to risering and heading castings.

General plant operating problems will be stressed in sessions on pattern making, sand research and refractories. An important section of the convention meetings will be sessions devoted to the completion of the lecture course on core practices and theories as given by H. W. Dietert, started last year. The material of these lectures will be available in book form, comprising a vast amount of data on all phases of core practices, including binders, baking, production, equipment, sands and processing. In compiling this material, Mr. Dietert has been assisted by a large number of men in the industry who have submitted data collected from plant practices.

New Foundry Installed for Washburne Students

By R. M. Schroeder,* Chicago, Ill.

WITH this nation actively engaged in war, President Roosevelt has asked for a 7-day work week for the duration, to bring this country's tremendous industrial power into play. To do such a job requires the full support of every employer and employee. Men and more men, and an increasing number of women, trained to industry's requirements, will be necessary to keep the industrial ball rolling at top speed. It will be the privilege of the nation's numerous trade schools to train many of the necessary workers, required in the Victory Program, in the various industrial arts.

For many years, Washburne Trade School, Chicago, Ill., has been training men for industry. As a part of the program, which is destined to make this school one of the outstanding trade schools in the country, a fully equipped foundry, from fillets to furnaces, has been added to give Chicago youth an opportunity to gain valuable fundamental training in the trades of this basic industry.

The new foundry has a 24-in. cupola making it possible to produce castings up to 3,000 lb. Additional melting units for aluminum, bronze and alloyed irons, include two crucible-type, gas-fired furnaces which have capacities of 90 and 150 lb. respectively. Castings made by the students will be used in the training of machinists.

Sand is prepared for foundry use in a portable mulling mill (Fig. 1) and a revivifier. Castings are cleaned in a blast cleaning mill, equipped with a dust arrester.

Compressed air is supplied to the blast cleaning mill, portable pneumatic grinder, air hammer, etc., by a 7½ h.p. compressor. A buffing and polishing lathe gives the student practice in preparing castings for the plating department. A stand-type grinder is used for grinding off gates and fins on unfinished castings.

Experience in molding machine work is obtained by the students on the hand squeezer

*Instructor in Foundry Practice, Washburne Trade School.

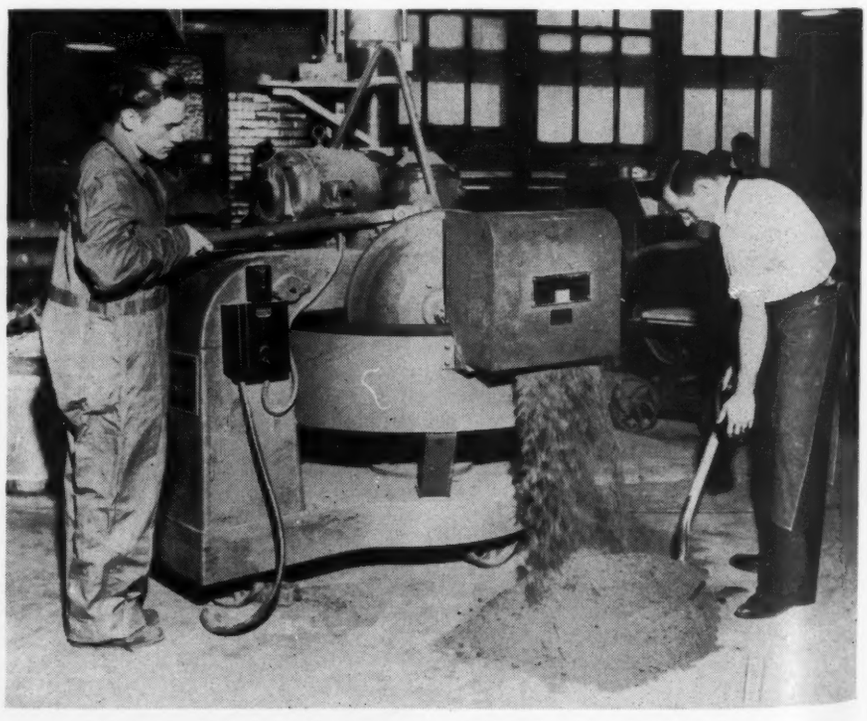


Fig. 1—Sand preparation is an important part of the foundry course at Washburne Trade School.

Fig. 2—The student will be instructed in the various phases of core baking.

machine and jolt-roll-over-pattern draw machines. Cores are baked in an automatically-controlled, recirculating-type core oven (Fig. 2). In this operation the student will be instructed as to ideal conditions under which cores should be baked.

Sand testing will be given as a part of the course and a complete line of sand testing equipment is being installed.

With the installation of this modern and up-to-date foundry in Washburne Trade School, men trained in the various foundry operations will be available to employers. Graduates of Washburne will be trained to take their place in the foundries of America to help produce those castings vital to the safeguarding of this nation in its Victory Program.

To Publish Graphite Classification Chart

AT the June, 1941, meeting of the American Society for Testing Materials, culminating a cooperative effort of the A.F.A. Gray Iron Division Committee on Classification of Graphite in Gray Iron and A.S.T.M. Committee A-3, Subcommittee VII on Microstructure of Cast Iron, A.S.T.M. Committee A-3 accepted as tentative the *"Recommended Practice for Evaluating the Microstructure of Graphite in Gray Iron."* The A.F.A. committee was under the chairmanship of W. E. Mahin, metallurgical engineer, Feeder Engineering Dept., Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., while the A.S.T.M. subcommittee was chairmaned by G. F. Comstock, metallurgist, Titanium Alloy Mfg. Co., Niagara Falls, N. Y.

Under the cooperative agreement established between A.F.A. and A.S.T.M., the graphite classification charts contained in the recommended practice soon will be published by A.F.A., and made available to those interested in the microstructure of gray iron.

It should be remembered that *this recommended practice is in no way to be construed as a specification.* The practice is offered primarily to permit accurate reporting of gray iron microstructures and to facilitate the comparison of reports by various workers or laboratories.

On publication, a small fee will be charged to cover the printing cost.

Book Review

The Foundry, by W. W. Young; paper cover with spiral binding; containing 99 pages and over 40 illustrations; price $1.75 plus five cents sales tax, Stanford Bookstore, Stanford University, California. A book written for students and apprentices wanting to gain some fundamental knowledge concerning foundry practice. This book is intended to familiarize students with the different metals suitable for casting, teach them fundamental principles of the design and production of castings and to give them some general information about foundry practice. The author presents discussions about castings, pattern design, molding, cleaning, melting and testing. He delves further into the practices of the steel foundry, cast iron foundry, brass foundry and malleable iron foundry. This book is quite wide in scope but could be made to fit into any foundry apprentice course where a thorough understanding of foundry fundamentals is necessary.

New A.S.T.M. Non-Ferrous Casting Specifications

AS noted in the August, 1941, issue of *American Foundryman,* the American Society for Testing Materials, at its June meeting, passed to the tentative standard status seven new specifications covering copper and copper alloy sand castings. For the benefit of non-ferrous foundrymen, below are listed the numbers assigned to these new tentative standards, together with their titles.

B 143—41 T — Tin-Bronze and Leaded Tin-Bronze Sand Castings.

B 144—41 T — High-Leaded Tin Bronze Sand Castings.

B 145—41 T—Leaded Red Brass and Leaded Semi-Red Brass Sand Castings.

B 146—41 T — Leaded Yellow Brass Sand Castings for General Purposes.

B 147—41 T — High-Strength Yellow Brass and High-Strength Leaded Yellow Brass Sand Castings.

B 148—41 T—Aluminum-Bronze Sand Castings.

B 149—41 T—Leaded Nickel-Brass (Leaded Nickel-Silver) and Leaded Nickel-Bronze (Nickel-Silver) Sand Castings.

It is interesting to note that Specifications B 143 — 41T was originally promulgated to replace Standard Specification B 60—36 covering castings of the alloy, copper 88 per cent, tin 8 per cent, zinc 4 per cent, and Standard Specification B 61—40 for Steam or Valve Bronze Castings. This action did not take place at the June meeting of the A.S.T.M. The two specifications to be replaced, as noted above, were revised and will remain A.S.T.M. standards until the new Specification B 143—41T is more familiar to consumers.

New Specification B 145—41T originally was to replace Standard Specification B 62—36 for Composition Brass or Ounce Metal Castings. The latter specification also has been revised and retained and will be replaced by the new specification when and if consumers become familiar with it.

Measuring the Fluidity of Cast Steel--I†

By H. F. Taylor* and E. A. Rominski,* Washington, D. C.

H. F. Taylor

A test mold employing a spiral flow channel is described which can be used satisfactorily for measuring the fluidity (castability) of steel in the furnace prior to tapping or in the ladle on the pouring floor. Advantages resulting from the use of this test for measuring the fluidity of the steel made in the 3-phase, electric-arc furnace at the Naval Research Laboratory are described. It is possible to follow changes in the castability of steel brought about by deoxidizers and alloying elements or by variations in temperature or in furnace practice. The technique for obtaining such information is described. This is the first section of this paper on fluidity and the second will be presented in a later issue.

E. A. Rominski

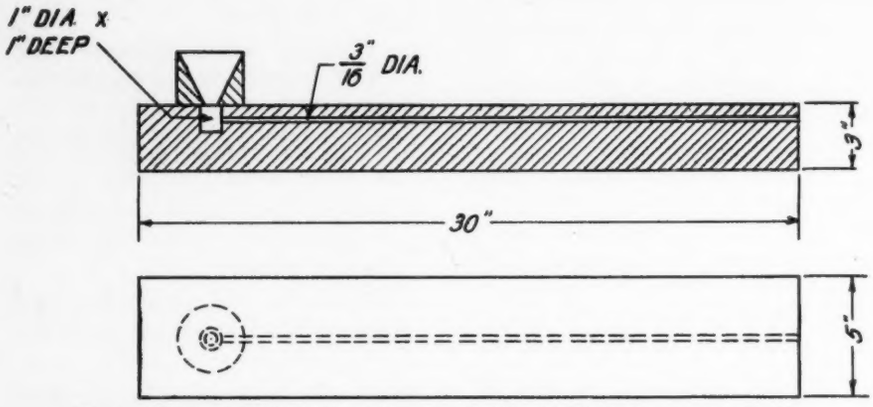


Fig. 1—Details of Ruff, 3/16-in. Diameter, Fluidity Mold for Comparison Tests.

TO obtain the best possible steel casting, the quality of the molten metal must be considered. Not only must composition be held to rigid specifications but fluidity (variously termed "castability," "life," "fluid life," "runnability" or "shankability") must be such that the molds will be readily and satisfactorily filled. Porous and incompletely run castings, lapped surfaces and unfaithful mold reproduction often can be laid directly to the sluggishness of the steel used for pouring. Badly skulled ladles, with their corresponding inconveniences, are not an uncommon problem. It has been suggested from time to time that the efficiency of risers, center line weakness, resistance to hot tearing and the like, may be influenced by the fluidity of the casting metal.

The problem undertaken at the Naval Research Laboratory consisted of:

(a) Development of a mold and technique of testing suitable for measuring the flowing quality of steel in the furnace to determine proper tapping time; and

(b) A modification of this test to enable the foundryman to determine the fluidity of the steel in the ladle at any particular time.

The experimental test piece developed at the Naval Research Laboratory proved so satisfactory that it was modified to fulfill both requirements.

The final choice of test piece for fluidity measurements was influenced by the following requirements:

(a) The test piece should be capable of measuring accurately small variations in fluidity and yet faithfully evaluate maximum and minimum values which result from extreme conditions of temperature and composition.

(b) The mold must be simple, inexpensive and convenient to prepare, easy to manipulate and direct reading. Accurate leveling should not be necessary and provision should

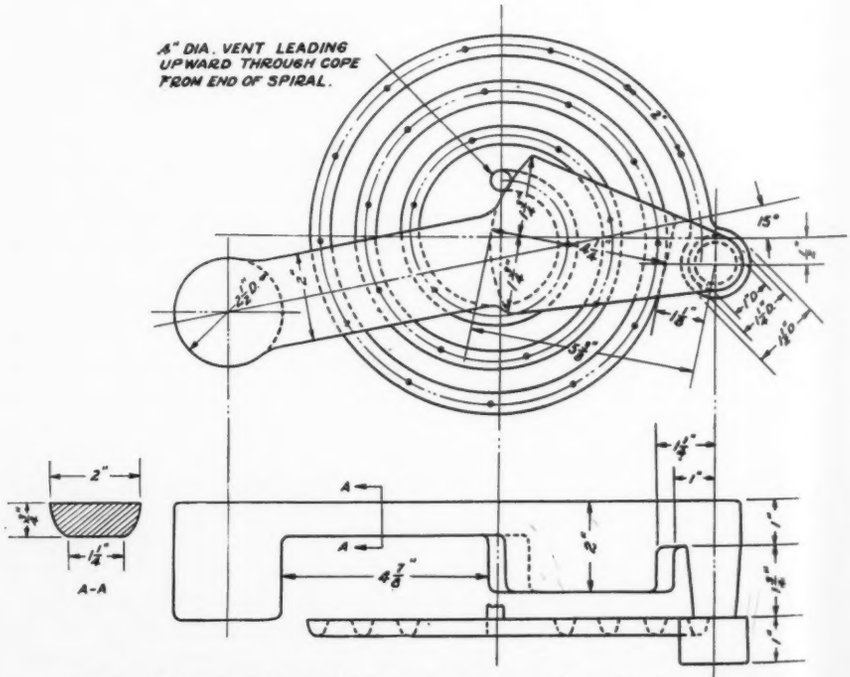


Fig. 2—Fluidity Spiral, Straight Down-Gate Type, with Modified Pouring Basin.

*Associate Metallurgist and Assistant Metallurgist, respectively, Naval Research Laboratory, Anacostia Station.

† Published by permission of Navy Department.

be made for maintenance of a constant flow head or at least one which varies within narrow limits.

(c) Results from the test piece should be reproducible.

Practical and Theoretical Considerations

The spiral type test piece for measuring the fluidity of cast metals was proposed as early as 1919, but it remained for Saeger and Krynitsky, working at the National Bureau of Standards, to adapt it for use with cast iron and non-ferrous metals. The work was published in 1936 and later this test became an American Foundrymen's Association recommended practice for measuring the fluidity of these metals.

Several attempts have been recorded where a spiral flow channel has been tried with cast steel but little success reported. Some time prior to 1936, Ruff found the spiral not fully satisfactory and concluded that dynamic laws applied more directly when straight flow channels were employed. Accordingly, he developed a test for use in measuring the fluidity of cast steel which involved a straight cylindrical flow channel 3/16-in. diameter fed through a simple conical runner. Figure 1 shows the mold recommended by him for experimental and shop use. In all tests discussed, the flow channel was made in sand molds of either the green or air dried type. The straight flow channel has been used extensively in England for both research and plant testing and to some extent in America. Opinion varies widely on the effectiveness of this method of testing for routine foundry practice.

Kron and Lorig, working at Battelle Memorial Institute, published the results of work on the subject in 1940. They used straight flow channels, 7/32-in. diameter, and their mold was an improvement over that of Ruff because of the inclusion in the design of a carefully controlled ferrostatic head which governed the entry of metal into the flow channel.

From a careful study of the results obtained by the various investigators using the straight flow channel, it was apparent that this type offered little promise as a foundry tool. Test values were not dependable and lengths of flow were very short. However, several tests were made at the Naval Research Laboratory before this type was discarded in favor of the spiral type.

The results of preliminary tests indicated the following:

(a) The Ruff mold, unless provided with means of controlling ferrostatic head and regulating the flow of metal, did not give consistently reproducible results and experimental points were badly scattered.

(b) The 3/16-in. diameter flow channel failed to give significant lengths of flow in steels which were still fluid enough to fill a mold. The maximum lengths of flow for steel of average analysis at normal pouring temperature were never greater than 12 in. It was impossible, in this size channel, to accurately measure small variations in fluidity.

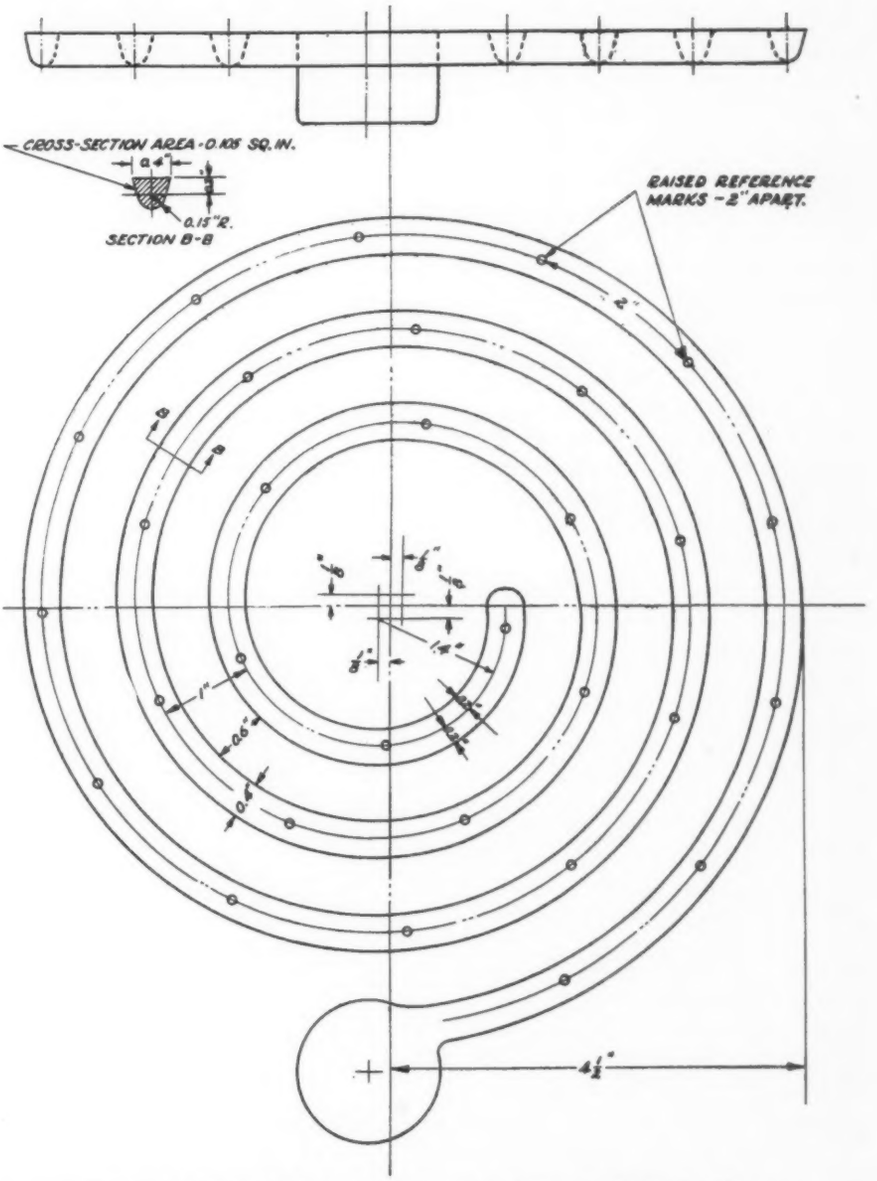


Fig. 3—Detailed Modified Naval Research Laboratory Fluidity Test Piece.

(c) The mold employing a straight flow channel required careful leveling before pouring.

Because of the success reported when Saeger and Krynit-

sky used the spiral mold for measuring the fluidity of cast iron, this type offered more promise as a test for cast steel. Accordingly, this type was next tried, and after the modifications necessary to adapt it to steel, a satisfactory test was developed. The details of the final design are given in Figs. 2, 3, and 4, and photographs of actual molds are shown in Figs. 5, 6, 7, and 8.

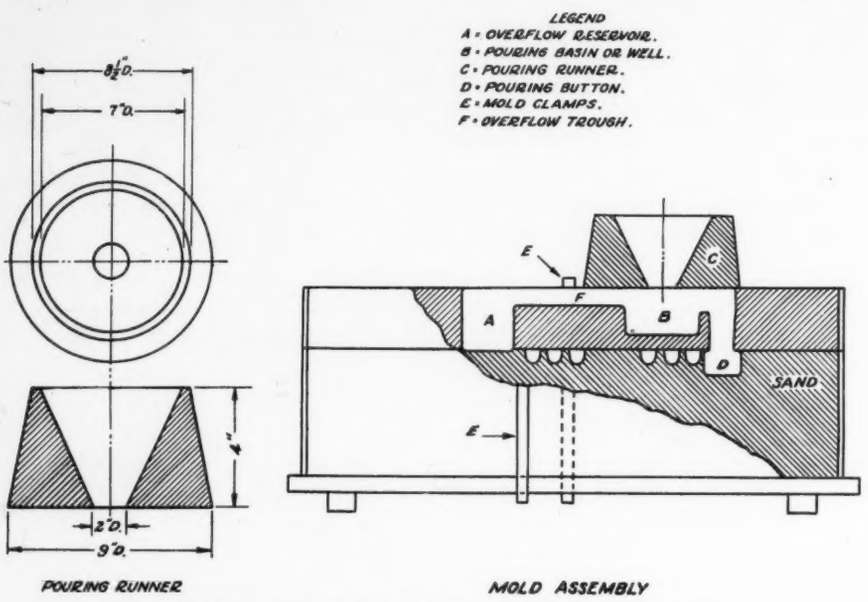


Fig. 4—Mold Assembly of Fluidity Test with Details of Pouring Runner.

To standardize the method, however, it was necessary to determine the influence of variables, in particular to determine the effect of sand grain size, of green, dry, and cement sand, pouring height, and in the case of tests at the arc furnace, to determine the effect of time of holding the sample in the spoon before pouring and to determine the amount of aluminum to be added to the spoon sample. The results of such tests as were found necessary to evaluate these variables are summarized below. A more detailed treatment is given in Naval Research Laboratory Report No. M-1657 where results of individual experiments are given in detail.

Nearly all of the development work was done using a 300-lb. capacity induction furnace, as melting and sampling were greatly simplified and results were fully as applicable as though all tests had been made on spoon samples taken from the arc furnace. From the results of this work the following conclusions may be drawn:

(a) The spiral test piece, as finally adopted, is satisfactory for evaluating the fluidity of cast steel. Results are reproducible, and the mold is simple and convenient to prepare. Reference marks on the cope surface of the casting make it direct reading.

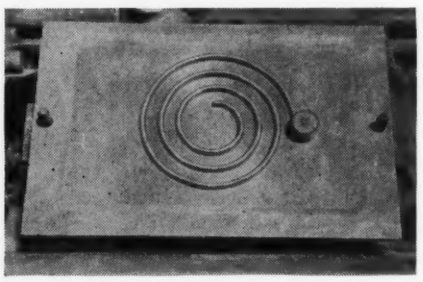


Fig. 5 — Drag Section of Fluidity Pattern Showing Blind Reservoir.

(b) Variations in sand grain size from A.F.A. fineness number 53 to 123 showed no selective influence on casting length. Molds made from bentonite bonded green and dried sand, and cement sand, when poured under identical conditions, gave equal spiral lengths. Thus the test is not sensitive to any normal differences in the various molding practices and results from all foundries would be comparable.

(c) Within reasonable limits (variations from 2 to 10-in. above the pouring basin) pouring height did not affect the reproducibility of the test.

(d) Varying the amount of aluminum added to 10-lb. spoon samples taken from the arc furnace indicated that 0.4 oz. (strip 3/16x 1/16x12-in. long) was the proper amount for average heats of plain carbon (0.15 to 0.30 per cent carbon) steel in the unkilled condition.

(e) In testing at the arc furnace, the time normally required to pour the fluidity test casting from the instant of dipping is about 4 sec. To determine what variation might exist as the speed of the operator varied from plant to plant, tests were made which proved that it was possible to hold the metal in a well slagged spoon as long as 15 sec. (ample time for the very slowest operator) without invalidating the results of the test.

(f) Composition has a marked influence on fluidity, the magnitude varying with the nature and amount of the alloying element. The state of oxidation of the bath is a major factor governing fluidity. Results indicated that a critical amount of deoxidation was essential to maximum flow. Variations above or below this value resulted in shorter spiral lengths for any given temperature.

(g) The temperature of the steel was found to have a predominant influence on casting length. The relationship for ordinary an-

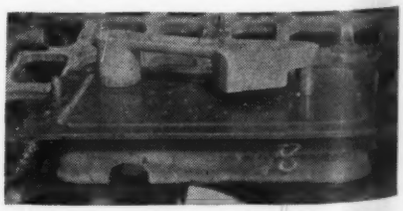


Fig. 6—Cope Section of Pattern with Pouring Basin in Place and Showing Raised Reference Marks.

alyses is not a linear function as the temperature increases from 1500°C. (2732°F.) to 1700°C. (3092°F.). The increase in test casting lengths, resulting from an increment of temperature change, decreases at the higher temperatures.

Description of Spiral Fluidity Test

Figures 2, 3, and 4 show the detailed dimensions of the spiral fluidity test piece finally adopted and Figs. 5, 6, 7, and 8 are photographs of the steps in preparing the mold. Ordinary molding technique is used and molds may be either green or dried sand. If dry or cement sand is employed, it is necessary to dry the molds assembled to prevent fins which would otherwise lead to poor results. Figure 8 shows a mold clamped and ready for use except for the addition of the runner guide. In making tests with this mold (Fig. 4), the steel is poured into the runner guide *(C)*, builds up to the lower overflow level, runs into a pouring button *(D)* and hence into the spiral. *(F)* is a second overflow trough, ¼-in. higher than the first, which empties into a catch basin *(A)*. This arrangement prevents the ferrostatic head from changing more than about ¼-in. and provides a smooth flow of metal into the spiral. A completely filled casting weighs 12 lb. when the overflow basin is filled. The usual test weight, however, is 8 lb., as it is not desirable to completely fill the overflow.

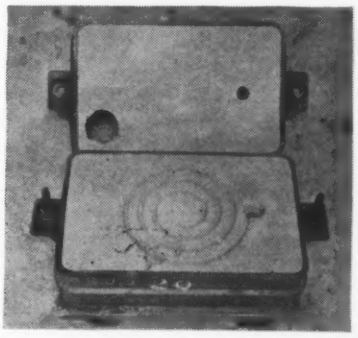


Fig. 7—Sand Mold Ready for Closing.

The testing technique finally adopted as standard practice for use with the laboratory ½-ton, 3-phase, arc furnace has proved very satisfactory and is shown by action photographs in Fig. 9. The mold described above is placed in position near the furnace door as shown in Fig. 9 —top left. The sampling spoon shown holds about 10 lb. of steel and is welded to a ¾-in. diameter rod 8-ft. long. A coil of aluminum (3/16x1/16x12-in. long wound on the end of a small rod) can just barely be seen lying on the front of the mold. These are all the essential requirements for the test. Whenever a test is desired, the operator warms the spoon and slags it carefully. The sample is taken at a point as near the center of the bath as

Fig. 8—Mold Assembled and Clamped.

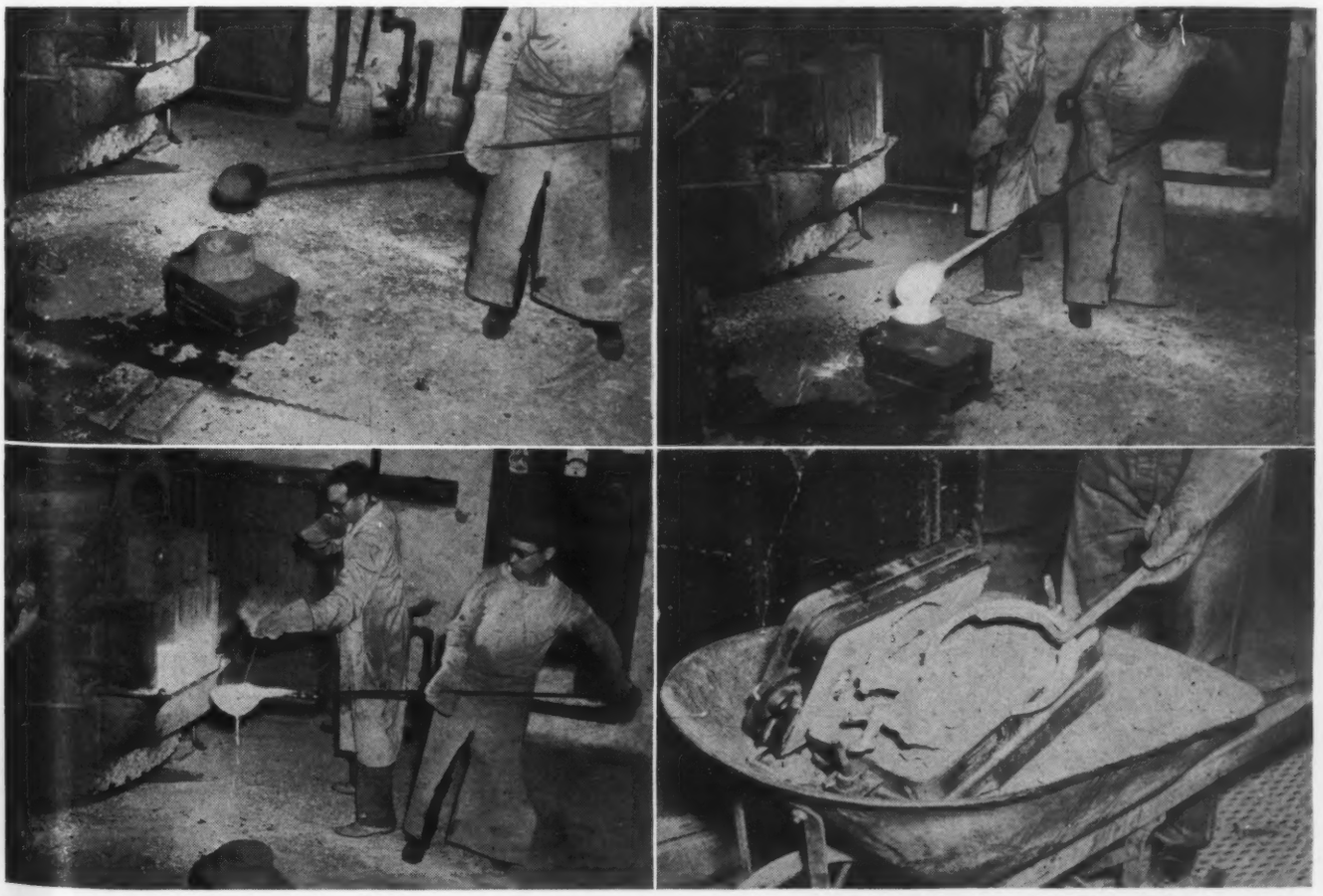


Fig. 9—Left Top—Spiral Mold and Operator Ready to Make Test. Left Bottom—Stirring the Aluminum Into the Spoon Sample. Right Top—Pouring the Sample Into the Spiral Test Mold. Right Bottom—Checking the Length of Flow as a Measure of Fluidity.

possible and quickly drawn from the furnace. As the spoon crosses the door sill, a second operator vigorously stirs in the small spiral of aluminum for deoxidization. He does this while the man handling the spoon is moving it into pouring position and does not interfere with the test. The spoon is then dumped without loss of time (but only conveniently fast) into the runner guide. It has not been found necessary to slag the sample in the spoon but this may be done if desired. The spiral immediately solidifies and can be shaken out of the mold and its length observed. Figure 9 shows the above operations clearly. The reference marks on the cope surface of the spiral are 2-in. apart and facilitate reading the length of flow which is taken as the index of fluidity. The aluminum only needs to be used for tests prior to final addition or when necessary to insure a killed sample, but as long as a standard practice is observed it will be satisfactory to use it at all times.

An Abstract of A.S.T.M. Standard Specifications for Gray Iron Castings

THIS specification bears the A.S.T.M. designation A 48-41 and contains the revisions made this year at the June meeting of A.S.T.M. The specifications cover general gray iron castings not covered by other existing A.S.T.M. specifications and apply to gray iron castings where strength is a consideration. The purpose of these specifications is to clarify cast irons according to tensile strength. The specifications are under the jurisdiction of A.S.T.M. Committee A-3 on Cast Iron.

According to these specifications, gray iron castings shall be known and listed by classes according to the following minimum requirements as to tensile strength of test bars:

Class	*Tensile Strength min., psi.*
No. 20	20,000
No. 25	25,000
No. 30	30,000
No. 35	35,000
No. 40	40,000
No. 50	50,000
No. 60	60,000

Transverse Test

The transverse test in these specifications is optional, but when specified, the breaking loads prescribed in Table 1 shall apply. By agreement between the manufacturer and purchaser, deflection values in the transverse or flexure test may be specified. It is further recommended that if such tests be performed that deflections at fracture be recorded and reported. The modulus of rupture for any bar tested under these specifications can be ascertained by application of the following formula:

$$\text{Modulus of rupture} = \frac{2.546\ LS}{D^3}$$

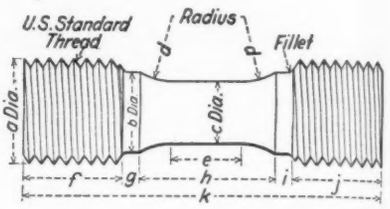
where:
L = span length or distance between supports in inches,
S = breaking load in pounds, and
D = diameter of the test bar in inches.

It is pointed out that the deflection values have been omitted from these specifications because the desired deflection would be governed by the use of the iron and, therefore, deflection figures should be reached by agreement between producer and consumer.

These specifications do not imply that the ratio of tensile strength to transverse load is a constant. If an iron is specified by class and the transverse or flexure test bar fails to meet the load requirements prescribed in Table 1, the manufacturer has the right to have a tension test specimen machined from a broken end of the transverse bar and tested. If the tension specimen conforms to the requirements of the specified class, the class requirements shall be considered as having been met, irrespective of the transverse or flexure breaking load.

Test Bars

Specification A 48-41 specifies three standard sizes of transverse or flexure test bars which shall be cast separately from the casting. The type test bar to be used shall be agreed upon between the manufacturer and the purchaser, depending upon the controlling section of the casting. After the controlling section has been determined, then the corresponding test bar shall be used as follows:



Dimensions of Tension Test Specimens, in.

Dimension	Specimen A	Specimen B	Specimen C
a	¾	1½	1⅞
b	⅝	⅞	1⅜
c	0.505	0.800	1.25
d	1.00	1.00	2.00
e[a]	Shall be equal or greater than *c* (diameter)		
f	1.00	1.00	1¾
g	0.25	0.25	⅝
h, min.	1.25	1.50	2¼
i	0.25	0.25	⅝
j	1.00	1.00	1¾
k, min.	3.75	4.00	6¾

[a] Length of parallel.

Fig. 1—Tension Test Specimens Machined from Transverse or Flexure Test Bars.

Controlling Section of Casting, in.	*Test Bar*	*Nominal Diameter of Test Bar as Cast, in.*
0.50 and under	A	0.875
0.51 to 1.00	B	1.20
1.01 to 2.00	C	2.00
Over 2.00	Test bar C may be used or a larger test bar may be used by agreement between the manufacturer and the purchaser.	

Tension test specimens shall be machined from the transverse

TABLE I.—TRANSVERSE OR FLEXURE BREAKING LOADS.

Transverse or flexure test bar Span length	0.875 in. in diameter 12-in. supports	1.2 in. in diameter 18-in. supports	2.0 in. in diameter 24-in. supports
Class	Breaking Load at Center, min., lb.	Breaking Load at Center, min., lb.	Breaking Load at Center, min., lb.
No. 20	900	1800	6 000
No. 25	1025	2000	6 800
No. 30	1150	2200	7 600
No. 35	1275	2400	8 300
No. 40	1400	2600	9 100
No. 50	1675	3000	10 300
No. 60	1925	3400	12 500

test bars to the dimensions shown in Fig. 1. The dimensions of the transverse or flexure test bars are shown in Fig. 2. This specification does not recognize

Transverse Test Bar	Dimensions Diameter, in.	Length, in.	Distance Between Supports in Transverse Test, in.
A	0.875	15	12
B	1.20	21	18
C	2.00	27	24

Fig. 2—Transverse or Flexure Test Bars.

tension test specimens "cast to size." When the controlling section of the casting is very heavy in comparison to other sections of the casting and if maximum strength is sought in the controlling section, it is possible that chilled spots may be found in the light sections. In such cases, the specification states it may be necessary to (1) use a lower strength class for the controlling section, or (2) modify the design to provide more section uniformity.

Molding and Pouring Test Bars

Unless otherwise agreed upon by the manufacturer and purchaser, test bars shall be made under the same sand conditions as the castings. The bars shall be poured from ladles of iron used to pour the castings. The test bars shall receive the same thermal treatment as the castings. In case of heat treatment, the test bars shall be treated adjacent to the castings they represent. In the explanatory notes of the specification, directions are given for the casting of transverse or flexure test bars.

Test Procedure

The specification outlines the procedure in the tensile strength and transverse tests. In the tensile strength test, it is specified that the load shall be axial and the use of self-aligning shackles is recommended. After reaching a stress equivalent to 15,000 psi., the speed of the moving head of the testing machine shall not exceed 1/8 in. (0.125 in.) per min.

Under the transverse test procedure, a method of making corrections for improperly sized bars is explained and reference is made to Table 2 which shows the correction factors for transverse or flexture test bars of the various specified diameters.

Number of Tests

In this specification, the manufacturer must prepare and furnish all test bars agreed upon and two or more test bars shall be cast. If a faulty or unsound test bar gives the result not in accordance with the specifications, the result shall be disregarded and another test made. Provisions are also made for retest in case of a test bar failing to conform to specifications.

Chemical Composition

According to these specifications, no chemical composition limits are given. The quantities of any chemical elements in the cast iron being made may be specified by agreement between the manufacturer and purchaser.

Requirements for Workmanship, Finish and Inspection

The requirements for workmanship, finish and inspection are much the same as those for other A.S.T.M. specifications. However, it is interesting to note that upon request of the purchaser, the manufacturer must be prepared to certify that his product conforms to the requirements of this specification if the product is ordered under it.

Full details of this specification have been issued under the title *"Standard Specifications for Gray Iron Castings,"* A.S.T.M. Designation A 48-41, and may be obtained either from the offices of your Association, 222 W. Adams St., Chicago, or from the American Society for Testing Materials, 260 S. Broad St., Philadelphia, Pa., for a nominal fee.

TABLE II.—CORRECTION FACTORS FOR TRANSVERSE OR FLEXURE TEST BARS.
In order to correct to the standard diameter, the breaking load and deflection obtained in testing the bar shall be divided by the respective correction factors.

Test Bar A 0.875 in. in Diameter			Test Bar B 1.20 in. in Diameter			Test Bar C 2.00 in. in Diameter		
Diameter of Test Bars, in.	Correction Factor		Diameter of Test Bars, in.	Correction Factor		Diameter of Test Bars, in.	Correction Factor	
	Load	Deflection		Load	Deflection		Load	Deflection
0.825	0.838	1.061	1.10	0.770	1.091	1.90	0.857	1.053
0.830	0.853	1.054	1.11	0.791	1.081	1.91	0.871	1.047
0.835	0.869	1.048	1.12	0.813	1.071	1.92	0.885	1.042
0.840	0.885	1.042	1.13	0.835	1.062	1.93	0.899	1.037
0.845	0.900	1.036	1.14	0.857	1.053	1.94	0.913	1.032
0.850	0.916	1.029	1.15	0.880	1.043	1.95	0.927	1.026
0.855	0.933	1.023	1.16	0.903	1.034	1.96	0.941	1.021
0.860	0.949	1.017	1.17	0.927	1.026	1.97	0.955	1.015
0.865	0.966	1.012	1.18	0.951	1.017	1.98	0.970	1.010
0.870	0.983	1.006	1.19	0.975	1.009	1.99	0.985	1.005
0.875	1.000	1.000	1.20	1.000	1.000	2.00	1.000	1.000
0.880	1.017	0.994	1.21	1.025	0.992	2.01	1.015	0.995
0.885	1.034	0.989	1.22	1.051	0.984	2.02	1.030	0.990
0.890	1.051	0.983	1.23	1.077	0.976	2.03	1.046	0.985
0.895	1.069	0.978	1.24	1.103	0.968	2.04	1.061	0.980
0.900	1.087	0.972	1.25	1.130	0.960	2.05	1.076	0.976
0.905	1.106	0.967	1.26	1.158	0.952	2.06	1.092	0.972
0.910	1.125	0.962	1.27	1.185	0.945	2.07	1.109	0.967
0.915	1.143	0.956	1.28	1.214	0.938	2.08	1.125	0.962
0.920	1.162	0.951	1.29	1.242	0.930	2.09	1.141	0.957
0.925	1.181	0.946	1.30	1.271	0.923	2.10	1.158	0.952

Book Review

Books, Publications and Patents of Battelle Memorial Institute, 1929-1940, published by Battelle Memorial Institute, Columbus, Ohio; paper cover; containing 47 pages. It has been the policy of the Battelle Memorial Institute to utilize the medium of the various journals in publishing the results of research in order to reach the greatest number of interested readers. This pamphlet contains a compilation of titles of books, publications, and patents, and an index to the subjects of these publications written by the staff since its inception as an industrial research institute in 1929. Also listed are the Battelle Fellowship Theses winners from Ohio State University.

In a rather recent issue of *American Foundryman* the Association advertised the sale of preprints discussed by Harry Dietert, Harry W. Dietert Co., Detroit, Mich., at the annual convention. These are going fast and members or non-members are urged to send in their requests immediately. The three papers are entitled Core Binders, Controlling Properties of Cores and Core Mixtures.

Western Michigan Gains Lead in Chapter Contest

NEW YEAR'S is a period of change—out with the old, in with the new. And there has been a real change in the chapter standing in the membership contest sponsored by the National Membership Committee under the chairmanship of B. D. Claffey, General Malleable Corp., Waukesha, Wisconsin, with E. W. Horlebein, Gibson & Kirk Co., Baltimore, as his vice chairman. That tough competitor, the Wisconsin chapter, winner of last year's membership contest, has been knocked out of the lead by its new competitor, Western Michigan. It looks as though this chapter membership contest is like a bridge game—friendship ceases in the competition.

This past month, Western Michigan not only gained No. 1 position in the contest, but also sent in the largest number of members, a total of 16. They have established a lead of 172 points over Wisconsin, but that probably will not worry Wisconsin much, as the tougher the going, the better Wisconsin likes it.

And look who is in second place — Northern Illinois-Southern Wisconsin, a sister chapter to Wisconsin, which leads the latter by 3 points. If Wisconsin is to duplicate its feat of last year, it has its work cut out for it.

(Photo courtesy S. N. Farmer, Sand Products Corp., Cleveland, Ohio)

Attention, Membership Chairman Ben Claffey. This is Toledo's contribution to the drive for new members. The pile of applications, along with the checks and dollar bills on the table, serve as a reminder that the "baby" chapter is doing its part in the campaign, too.

We also should point out that our baby chapter, Toledo, is in fourth place and also sent in the second largest total of memberships for the past month, 11, plus a conversion from a Personal to a Company membership. Central Indiana, with 10 new members during the past month, jumped from ninth to eighth place, in reality a jump of two places because of the addition of our new chapter at Toledo. Northern California jumped from 10th place to seventh place, and Twin City chapter from 16th to 13th. Wisconsin dropped to third place, Birmingham from sixth to ninth, Michiana from seventh to 11th and Southern California from 12th to 14th. There was little change in the placing of the other chapters, with the exception of Western New York, which jumped from 13th to 12th.

These changes in standing indicate the fairness of the basis for this membership contest. Even our new chapter, Toledo, with all its enthusiasm and the excellent opportunity to secure new members, could not displace any of the three leaders of last month.

On December 12, National Membership Chairman Claffey sent telegrams to the various

Chapter Membership Progress Report

Chapter		Membership as of 7/1/41	Chapter Quotas	Gain in Membership as of 12/15/41	Chapter Standing By Points
1	Western Michigan	50	68	26	371
2	Nor. Illinois-Sou. Wisconsin	40	46	8	202
3	Wisconsin	310	210	60	199
4	Toledo	43	60	11	190
5	Cincinnati District	141	141	21	157
6	Chicago	425	259	43	137
7	Northern California	107	99	12	104
8	Central Indiana	127	111	13	102
9	Birmingham District	242	125	15	94
10	Central New York	109	90	6	80
11	Michiana	67	101	10	78
12	Western New York	151	111	8	65
13	Twin City	66	84	10	56
14	Southern California	194	201	13	54
15	Ontario	98	199	11	48
16	Metropolitan	172	210	13	47
17	Quad City	129	41	3	30
18	Chesapeake	154	159	8	28
19	Philadelphia	185	237	5	23
20	Northeastern Ohio	328	243	8	18
21	St. Louis District	135	90	0*	16
22	Detroit	231	196	-1	-3
		3504		303	

*While a chapter may show no increase in membership, it is possible to show a gain in the *Chapter Standing by Points* column by converting a personal to a company membership or a company to a sustaining membership, since each class of membership carries a different credit in points.

The above figures do not include membership of non chapter areas.

chapters and suggested that chapter membership committees be called together and action urged. It is interesting to note in this month's report that only eight of our 22 chapters have passed the 100 point mark. It would take but a few members to push several over the line, while others have their work definitely cut out for them. Remember the slogan adopted by the National Membership Committee, "5000 in '42."

Never has there been a time when membership in A.F.A. could serve a more useful purpose. With our national war program under way and the need for ever increasing production, more and more problems will arise that can be solved through the information given in the publications issued by the Association. Let's not forget also the friendship and contact angles which are definite aids to members of the Association. A.F.A. is growing and everyone likes to belong to a growing, forward-looking Association. So let's get busy so that everyone in the industry who is eligible for membership may have an opportunity to share the opportunities which it offers.

New Members

The smaller chapters stole the show this month with their membership committees really moving into high gear. Western Michigan tops the list with 16 new members. Fighting hard is the "baby" chapter, Toledo, with 11. Central Indiana came out one behind Toledo with 10, while Chicago obtained 6. The smaller chapters placed first, second and fourth this month which is putting pressure on the large chapters. See the chapter membership table and find out how your chapter stands.

November 16 to December 15, 1941

Conversions

Company from Personal

Atlas Foundry Co., Marion, Ind. (Frank X. Gartland, President).
Bunting Brass & Bronze Co., Toledo, Ohio (Leighton M. Long, Metallurgist).
Lumen Bearing Co., Buffalo, N. Y. (Joseph J. Mayer, Gen'l Supt.).

Birmingham District Chapter

S. C. Hane, Pres., Wallwork Foundry Co., Birmingham, Alabama.
D. J. Lundbom, Supt., Wallwork Foundry Co., Birmingham, Ala.

Canadian Section

Robert L. Doelman, Electric Steels, Ltd., Three Rivers, Que., Canada.
***Electric Steels, Ltd., Three Rivers, Que., Canada (M. L. Doelman, Gen'l Mgr.).**
J. U. MacEwan, Prof. of Met., Dept. of Mining and Metallurgical Engineering, McGill University, Montreal, Que., Canada.
Alex Pirrie, Electric Steels, Ltd., Three Rivers, Que., Canada.
J. F. Neill, Electric Steels, Ltd., Three Rivers, Que., Canada.

Central Indiana Chapter

A. Willard Anderson, Foreman, International Harvester Co., Indianapolis, Ind.
James W. Johnson, Hoosier Iron Works, Kokomo, Ind.
***Letukas Foundry, Upland, Ind. (Walter Letukas, Sr., Owner).**
Harley E. Patty, Supt., Atlas Foundry Co., Marion, Ind.
Wm. J. Price, Vice-Pres., Atlas Foundry Co., Marion, Indiana.
Harvey Rinearson, Hoosier Iron Works, Kokomo, Ind.
Richard J. Skillman, Indianapolis, Ind., Salesman, General Refractories Co., Chicago.
Geo. R. Slick, Vice-Pres., Beckett Bronze Co., Muncie, Indiana.
Louis Wagner, Cupola Foreman, Hoosier Iron Works, Kokomo, Ind.
Harold C. Weimer, Chemist, Hoosier Iron Works, Kokomo, Ind.

Chesapeake Chapter

Elwood Waite, Apprentice, Washington Navy Yard, Steel Foundry, Washington, D. C.

Chicago Chapter

Wm. J. Benner, Chicago, Ill., Vice-Pres. of Sales, Pyro Clay Products Co., Oak Hill, Ohio.
***Calumet Steel Castings Corp., Hammond, Ind. (B. A. Zikmund, Pres.).**
Lave G. Gustafson, Asst. Foreman (Patt. Shop), Continental Roll & Steel Foundry Co., East Chicago, Ind.
John Johnson, Jr., Supt., Tarrant Foundry Co., Chicago, Illinois.
John S. Joyce, Heat Treater, Continental Roll & Steel Foundry Co., E. Chicago, Ind.
Irven Merner, Asst. Supt., Tarrant Foundry Co., Chicago, Ill.

Cincinnati District Chapter

Gerald L. Brunsman, Met., The Lunkenheimer Co., Cincinnati, Ohio.

Metropolitan Chapter

Edmund J. Antczak, Student, Bayonne Technical School, Bayonne, N. J.
Davidlee V. Ludwig, Met., Capital Foundry Co., Astoria, L. I., N. Y.

Michiana Chapter

D. Goddard, Michiana Products Corp., Michigan City, Indiana.

Northeastern Ohio Chapter

T. H. Terry, Salesman, Federal Foundry Supply Co., Cleveland, Ohio.
Russell W. Wenk, Pres., East Akron Casting Co., Akron, Ohio.

Northern California Chapter

C. L. Boone, Salesman, Pacific Graphite Works, Oakland, Calif.
Clarence E. Dubbs, Inspector, Vulcan Foundry Co., Oakland, Calif.
***M. Greenberg's Sons, San Francisco, Calif. (Maurice S. Greenberg, Partner).**
Charles T. Post, West Coast Editor, The Iron Age, San Francisco, Calif.
Paul Switzer, Patternmaker, Vulcan Foundry Co., Oakland, Calif.

Ontario Chapter

N. B. Brown, Engr., Div. of Metallic Minerals, Bureau of Mines, Ottawa, Ont., Canada.
Wm. Ferguson, Foreman, Fittings, Ltd., Oshawa, Ont., Canada.
E. Moss, Foundry Foreman, Waterloo Manufacturing Co., Waterloo, Ont., Canada.

Philadelphia Chapter

Ralph W. Manzene, Philadelphia, Pa., Sales Rep., Safety Grinding Wheel & Mach. Co., Springfield, Ohio.
Edward Saks, Instructor, Dobbins Vocational School, Philadelphia, Pa.
Alfred P. Smith, Metal Patternmaker, Kitson Company, Philadelphia, Pa.

*Company Members

Southern California Chapter

James F. Addington, Sales Engr., Ingersoll-Rand Co., Los Angeles, Calif.
F. Harwood Clark, Mgr., Torrance Brass Foundry, Torrance, Calif.
John F. Gerwig, Asst. Supt., Magnesium Products, Inc., Los Angeles, Calif.
Russell B. Olds, President, Olds Alloys Co., Los Angeles, Calif.

Toledo Chapter

M. Bogusz, Gen. Fdry. Foreman, Bunting Brass & Bronze Co., Toledo, Ohio.
R. B. Bunting, Met., Bunting Brass & Bronze Co., Toledo, Ohio.
*Ensign Foundry Co., Toledo, Ohio (F. F. Ensign, Vice-President).
L. E. Fischer, Grinding Room Foreman, Bunting Brass & Bronze Co., Toledo, Ohio.
*Freeman Supply Co., Toledo, Ohio (Doyle Carbin, Sales).
Edgar K. Rogers, Asst. Fdry. Supt., Bunting Brass & Bronze Co., Toledo, Ohio.
*Schill Pattern Co., Toledo, Ohio (George Wandtke, Pres.).
Dan Schmidt, Fdry. Foreman, Bunting Brass & Bronze Co., Toledo, Ohio.
Harry G. Schwab, Met., Bunting Brass & Bronze Co., Toledo, Ohio.
Philip F. Stevens, Prop., Toledo Pattern Works, Toledo, Ohio.
Leo I. Wernert, National Supply Co., Toledo, Ohio.

Twin-City Chapter

Fred Brandt, Student, University of Minnesota, Minneapolis, Minn.
Harry R. Dahlberg, Student, University of Minnesota, Minneapolis, Minn.
Russell Gunderson, Student, University of Minnesota, Minneapolis, Minn.
O. K. Mayhew, Supt., Hart Carter Co., Minneapolis, Minnesota.
John Uppgren, Student, University of Minnesota, Minneapolis, Minn.

Western Michigan Chapter

Charles Angers, West Michigan Steel Foundry Co., Muskegon, Mich.
Harley Bollenbacker, West Michigan Steel Foundry Co., Muskegon, Mich.
H. W. Clover, Vice-Pres., Clover Foundry Co., Muskegon, Mich.
*Connor Foundry Co., Grand Rapids, Mich. (Lloyd Norton, Partner).
Carl N. Damm, Pyle Pattern & Mfg. Co., Muskegon Heights, Mich.
Nelson E. Damm, Pyle Pattern & Mfg. Co., Muskegon Heights, Mich.
R. B. Emens, Spring Lake, Mich., Sales Engr., Fairbanks, Morse & Co., Chicago, Ill.
Willard R. Gates, Sales Engr., Macklin Company, Jackson, Mich.
George Gokey, West Michigan Steel Foundry Co., Muskegon, Mich.
Arthur Jeannot, West Michigan Steel Foundry Co., Muskegon, Mich.
Richard G. Kreifeldt, Foreman, Clover Foundry Co., Muskegon, Mich.
*Lakeshore Machinery & Supply Co., Muskegon, Mich. (A. G. Raddatz, Vice-Pres.).
Leo A. Maihofer, Accountant, Clover Foundry Co., Muskegon, Mich.
*Montague Castings Co., Montague, Mich. (R. C. Carlson, President).
Victor A. Pyle, Pyle Pattern & Mfg. Co., Muskegon Heights, Mich.
Wm. Robinson, West Michigan Steel Foundry Co., Muskegon, Mich.

Western New York Chapter

John W. Considine, Supt., Jewell Alloy & Malleable Co., Buffalo, N. Y.
Joseph P. Dunphy, Foundry Supt., The Symington-Gould Corp., Rochester, N. Y.
Milo O. Green, Sales, Sargent and Greenleaf Co., Rochester, N. Y.
Alfred E. Hefferan, Molding Foreman, Jewell Alloy & Malleable Co., Buffalo, N. Y.
Elliott R. Jones, Plant Supt., Lumen Bearing Co., Buffalo, N. Y.

Wisconsin Chapter

Orville T. Holom, Nordberg Mfg. Co., Milwaukee, Wis.
Robert Alexander McKee, Accountant, Nordberg Mfg. Co., Milwaukee, Wis.
Anton Pintar, Molder, Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Andrew H. Zaborski, Asst. Foreman, Geo. J. Meyer Co., Cudahy, Wis.

Outside of Chapter

T. H. Bower, Chief Engineer's Office, Crossley Brothers, Ltd., Lancashire, England.
Ernest B. Brown, Sand Control Chemist, Stanton Ironworks Co., Ltd., Nottingham, England.
*Castalloy Company, Inc., Cambridge, Mass. (Francis McConville, Treas.).
Dan A. Sutch, Foundry Supt., Vulcan Iron Works, Wilkes-Barre, Pa.
Charles Winters, Pres., Acme Brass Foundry Co., Inc., Lowell, Mass.

New Management Series On Cost and Time Study

TWO 1941 Management Series pamphlets have been published by the American Foundrymen's Association and are ready for distribution.

Number 10 in this series of "hits" is the "Classification of Foundry Cost Factors." This booklet has been prepared by the A.F.A. Cost Committee and is the result of several years of study and research. This booklet contains a comparison of the cost items of the four major foundry branches, namely, steel, malleable, cast iron and non-ferrous, and shows, in simple form, the basic similarities and differences between the various cost factors.

The eleventh book in this series, "Time Study Measurements and Job Evaluation," contains two papers presented at a session on those subjects at the 45th Annual Convention. The first paper by Phil Carroll, Jr., "Practical Time Study Measurements for Foundry Operations," tells how to obtain time study data by breaking down the particular operation being considered into constant elements which are the same for every job, regardless of its size; and variable elements which are dependent on the type and size of casting being made.

The second paper in this booklet is written by A. L. Kress on "Job Evaluation and Employee Rating." The author deals with the adjustment of day work base rates so that they will be fair alike to employer and employee. Further discussion on such subjects as a rating plan, wage scale and minimum hiring rate are discussed in detail.

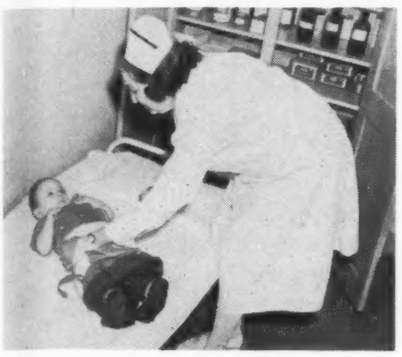
Each of these two publications is available to A.F.A. members at 50c per copy. The price to non-members is $1.00 per capy.

Combination Offer

A combination offer of these two publications plus the 1940 issue of Job Evaluation and Time Study can be obtained by A.F.A. members for $1.25. The price to non-members is $3.00 for these three publications.

Hamilton Foundry & Machine Celebrates 50th Anniversary With Plant Visitation

A MOST successful celebration commemorating the Hamilton Foundry and Machine Company's fiftieth anniversary was held Sunday, November 9, at their plant in Hamilton, Ohio, from 11 a. m. till 4 p. m. Peter E. Rentschler, president of the company, reports that 1078 people registered for the plant visitation tour and participated in the other activities held during the day.



Emergency!

The safety and hygiene campaign, promoted by the company under the auspices of the Industrial Commission of Ohio and the National Safety Council received a great deal of attention. The pictures along the side of the page illustrate the interest shown in this exhibit and what it contains. Some of the items seen are safety and health devices used in the plant; unsafe tools and equipment; accident prevention and health signs; first aid room; and statistical record boards showing lost time accidents requiring doctor's care, accidents without lost time requiring doctor's care and first aid cases; and other safety signs.

Movies were shown at various times throughout the afternoon so that everyone would have a chance to see them. A wide variety of pictures were shown, including an official U. S. Navy sound film; colored pictures of the sesqui-centennial parade in which the Hamilton foundry took an active part; the erection of two new cupolas and cupola building, and a comedy.

The conducted tours of the plant gave many a chance to see the job fathers, husbands, sons or friends did, at what place in the plant they worked and the type of work performed. Upon registering each visitor was presented a program outlining the day's activities and on the reverse side was a review of the plant tour and instructions as to what machines and equipment to look for and where they would be located in relation to the position of the visiting group going through the plant.

Refreshments were served in the company's lunch room.

Pictures Taken at The Hamilton Foundry and Machine Co., Hamilton, O., During Fiftieth Anniversary Celebration.

Ram Off or Ram Away Problems in Gray Iron Casting Production

By Wm. C. Wine,* South Bend, Ind.

This is the second of a series of articles prepared by members of the Gray Iron Division Committee on Analysis of Castings Defects. The present discussion portrays defects in connection with ram off and lists causes of defects and possible remedies. The December issue of American Foundryman carried a report on blows in gray iron castings presented by W. A. Hambley, committee chairman, and metallurgist, Allis-Chalmers Mfg. Co., Milwaukee, Wis.

THE list of defects as set up by this committee and published on page 16 of the November issue of *American Foundryman*, shows ram off or ram away as defect number 10. It is being discussed early in this series because, to date, there has been very little written about this particular defect. It is our hope that this discussion, as well as others to follow, will create enough general interest in

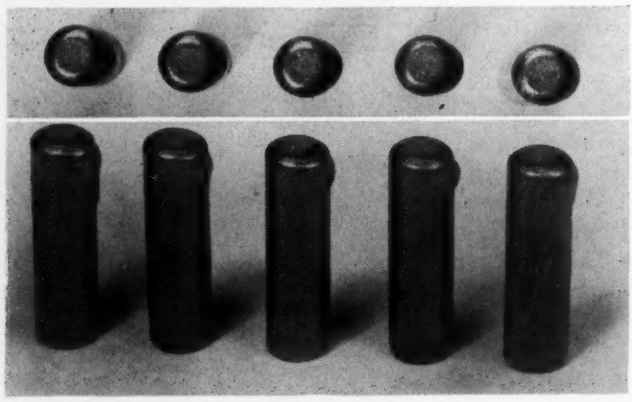


Fig. 1—Top and side views of castings showing ram off.

the work of this committee that we may receive many helpful suggestions and constructive criticisms on our work, so that when completed it will be satisfactory to, and usable by, the greatest possible number of foundrymen.

No. 10. Ram Off or Ram Away

Definition:

Ram Off or Ram Away—A casting with additional metal that does not conform to the contour of the pattern. Usually has the appearance of a shift with excess metal, but may match on the opposite side.

Causes:

A. *Due to Design*—None

B. *Due to Pattern, Flask Equipment and Rigging*

1. Loose pieces not properly secured to pattern.
2. Pattern plate not equipped with ram off strips.
3. Patterns too close together.
4. Patterns too close to edge of flask.
5. Pattern or plate too smooth.
6. Loose squeeze head on molding machine (Fig. 1).

C. *Due to Sand*

1. Too low flowability.
   a. Too high bonding material content.
   b. Too high moisture content.
   c. Too much carbonaceous or gas producing material.
   d. Improper shape and distribution of grains.
   e. Too high in farinaceous material.
   f. Type of clay used.

D. *Due to Cores*—None.

E. *Due to Molding Practice, Gating and Risering*

1. Improper filling of flask with sand (Fig. 2).
2. Improper ramming and peening without regard to direction of ramming.

Fig. 2—Hand wheel (above) shows ram off at left of center boss. Lever (below) shows ram off at left of center boss and at left of boss on right.

*Foundry General Superintendent, Sibley Machine & Foundry Co., and Member, Gray Iron Division Committee on Analysis of Castings Defects.

3. Improper ramming around loose pieces and bosses.
4. Filling flask too full before peening, ramming or jolting.
5. Improper jolting on jolt machines.
6. Misplacing loose pieces in ramming.
7. Misplacing ram-up cores.

F. *Due to Iron Composition*—None.
G. *Due to Cupola Operation*—None.
H. *Due to Pouring*—None.
I. *Miscellaneous*—None.

Defective castings shown in Fig. 1 are most often caused by B-6, but can also be caused by B-3, B-4, B-5, C-1, E-1, E-4 and E-5.

In making the molds for both castings shown in Fig. 2, sand was riddled over pattern until pattern was covered. This sand takes the exact contour of the pattern. When the flask was filled with sand it was thrown in at an angle from the right and with force enough to provide ramming or sliding action to slide the first sand off of the bosses and to the left. When these molds were squeezed, the sand which was pushed to the left still held the contour of the pattern and was squeezed down below the top edge of the boss. The remedy for this is obvious; the filling of the flask with shovel should not be from an angle, but shovel should be turned over above the flask so that sand falls straight down.

The Responsibilities of Training Apprentices

By J. E. Goss,* Providence, R. I.

This is the second in a series of papers on apprenticeship presented by members of the A.F.A. Apprentice Training Committee. The first appeared on page 12 of the December issue of American Foundryman and was prepared by J. A. Bowers, American Cast Iron Pipe Co., Birmingham, Ala. This, the second article, is authored by J. E. Goss who has had extensive experience in apprentice training programs. He has been employed by the Brown & Sharpe Mfg. Co. for the past 23 years, acting for several years as Supervisor of Apprentices. Born in Fall River, Mass., he received his fundamental schooling there, and later he completed extension courses at Brown University. Before entering the employment of Brown & Sharpe he served as an apprentice draftsman for the Corliss Steam Engine Works, Providence, R. I.; as a draftsman for the Taunton Locomotive Co., Taunton, Mass., and was an instructor in mechanical drawing at the Fall River High School. Mr. Goss has written extensively for industrial publications and has presented many papers before technical and trade organizations on the subject of apprentice training. The author has been a member of A.F.A. for several years and has participated in many apprentice training activities. At present he is a member of the Apprentice Training Committee and its Subcommittee on Program and Papers.

PROBABLY one of the most important points to be considered in foundry apprenticeship is to recognize the fact that the foreman should not be held wholly responsible for the instruction of apprentices. The foreman is a busy man, with many other duties besides those connected with training. We should not expect him to give his apprenticeship responsibilities precedence over his numerous other tasks.

He should not, however, be relieved of his general supervision over training, for to do this might lead to questions of authority and a lack of interest on his part in the apprentices' development. The foreman is responsible for the quality and quantity of work done in his department and apprentices should not be excepted in the matter of producing good castings.

If the number of apprentices warrant it, there should be an instructor with no other duties than those connected with the development of the apprentices. If there are only a few apprentices, all working in the same room, the problem can be solved by appointing a man to act as instructor at such times as his help may be needed by the apprentices.

Such a man should not, of course, be given rush jobs or work that is needed on regular

BROWN & SHARPE APPRENTICES WHO HAVE WON PRIZES
IN THE NATIONAL CONTESTS FOR APPRENTICES SPONSORED
BY THE AMERICAN FOUNDRYMEN'S ASSOCIATION
1927 Lester G. Furber Third Patternmaking
1928 Peter O. Battigate First Moulding
1929 Norman F. Chapman First Moulding
1929 Carl W. Hanstein Second Moulding
1929 Vasken Tatevossian Second Patternmaking
1929 Valmore N. Blais S. Ubermeyer Prize
1930 Moroni Heap First Moulding
1932 Moroni Heap First Moulding
1932 Oscar E. Frederick Second Patternmaking
1936 Russell L. Ashworth Third Moulding
1937 John Watkington Second Moulding
1938 Edward A. Menard Second Patternmaking
1939 Louis W. Greenslade Jr. First Moulding
1940 Thomas F. Murphy First Moulding
1941 Henry L. White First Moulding

Plaque containing names of Brown & Sharpe Mfg. Co. apprentices who have won prizes in the A.F.A. National Apprentice Contest.

A former Brown & Sharpe apprentice working on a mold in their foundry. (Left) Putting the pattern in position, and (right) putting the finishing touches on a mold.

*Supervisor of Apprenticeship, Brown & Sharpe Mfg. Co.

schedule. His purpose will not be served if it is necessary for him to frequently delay aiding the apprentices or if his production requirements are such that he cannot take the time to do a thorough job of instructing.

In selecting an instructor, it is not necessary to require a background of training in teaching methods. First, we should have a man who knows molding and coremaking, preferably one who learned his trade by means of apprenticeship and then spent at least 5 more years as a journeyman. Second, we should be sure that he is a man who will have a sincere interest in this type of work—one who likes to show others what he, himself, already knows. Third, he should have great patience. Fourth, he should have the ability to see beyond minor shortcomings, to the possibilities in young men. Fifth, he should derive great satisfaction from aiding in the development of apprentices, for only with such a spirit will he do the grade of work necessary for the best interests of both the apprentices and his employer. This type supervisor would indeed be valuable to all concerned as an instructor and a good worker.

New Committee Members

Patternmaking Division — Handbook Revision Committee.

Adam Pyle, Jr., Secy.-Treas., Pyle Pattern & Mfg. Co., 1201 Sanford St. Muskegon, Mich.

L. F. Tucker, City Pattern Works, 422 E. Monroe St., South Bend, Ind.

Steel Division—Committee on Methods of Producing Steel for Castings.

W. Harvey Payne, Pres., Hydro-Arc Furnace Corp., 9 S. Clinton St., Chicago Illinois.

Committee on Co-operation with Engineering Schools.

S. D. Moxley, Asst. to Vice Pres., American Cast Iron Pipe Co., Birmingham, Alabama.

Gray Iron Division Cupola Research — Subcommittee on Equipment.

R. M. Walker, Bristol Co., Waterbury, Conn.

Volume 49 Transactions Nears Completed Stage

ANOTHER volume of the American Foundrymen's Association *Bound Volume Transactions*, containing practical and valuable foundry information, is soon to be printed and released so that this vast amount of data can be added to your library of practical knowledge, and aid you in solving numerous problems arising in your foundry daily. Volume 49 contains the papers, reports and discussions of the 1941 New York City convention held May 12-15, at the Hotel Pennsylvania.

In complying with the publication policy of the Association, *Bound Volume Transactions* are sent to company members gratis on request. Prior to the printing of the book, each company member representative will receive a card on which he will ask that this publication be forwarded to him.

Personal members receive the material contained in the *Bound Volume Transactions* in the *Quarterly Transactions*, but many will want the *Bound Volume Transactions* for permanent reference use. These members may purchase copies of the *Bound Volume Transactions* for $3.00. Price to non-members is $15.00.

Order cards are sent to personal members as many of these members find the *Bound Volume Transactions* easier to keep and use as a permanent reference. It is urged that members seeking back issues of bound volumes place their orders in the near future as only a limited supply of bound volumes 45 (1937), 46 (1938), 47 (1939) and 48 (1940) are available.

Volume 49 will probably be one of the most interesting and informative volumes published by the Association. Due to the wide range of subjects covered, the information it contains and the data presented will make it a "must" for your technical library. Some of the high spots are the sand progress report on investigation of effect of high temperatures on steel sands; a committee report on the classification of foundry costs for the four branches of the foundry industry; papers on heat treatment, gating and risering, use of alloys, temperature measurement, study of silicon-bronzes, cupola practice, centrifugal casting and equipment; and many other topics of general and specific interest.

Bound Volume 49 of *Transactions* will be well illustrated with pictures, graphs, charts and drawings. It will be well worth your while to be sure and add this edition to your library of foundry publications concerning foundry practice and technology.

10-Year Index

Compiled and published last year by the American Foundrymen's Association is the 10-year *Index* to A.F.A. bound volume and quarterly *Transactions*. This book was prepared as the third *Index* to the Bound Volume *Transactions*. This, the 1941 edition, covers Vols. XXXVIII (38) to XLVIII (48) (1930-1940) inclusive. The bound volumes of A.F.A. *Transactions* contain a vast amount of practical, technical and scientific data of vital interest to those engaged in the casting of metals. However, prior to the issuance of the first *Index* the value and usefulness of their information and data had been seriously impaired, due to its relative inaccessability to members of the industry. Consequently an *Index* was needed and it was provided from time to time, usually every 10 years, by the Association. The contents of each paper and report have been cross-indexed quite freely. It includes nearly all headings under which the reader might reasonably expect to find the desired information. An author's index also appears in the latter part of the *Index*.

CHAPTER OFFICERS

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Sivyer Steel Casting Co.,
Milwaukee, Wis.
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Harry W. Dietert Co.,
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M. Kuniansky
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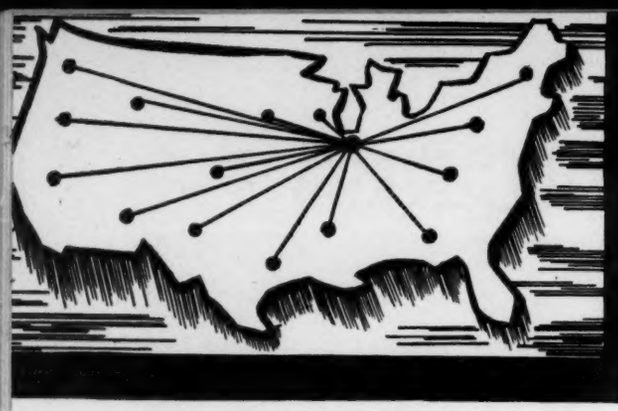


Chapter Activities

Chicago Discusses Cores and the Scrap Situation

THE December meeting of the Chicago chapter was held December 8 at the Top of the Town Restaurant with 125 present for the dinner. Chapter Chairman L. L. Henkel, Interlake Iron Corp., presided.

Following the dinner the members and guests were conducted by Art Lambrecht, Chicago Heights, Ill., in a group singing demonstration. After this treat the men split up into two groups —one covering non-ferrous and the other gray iron, malleable and steel.

The non-ferrous group was presided over by Cliff McKelvey, Chicago Hardware Foundry Co., North Chicago, Ill. The speaker was C. V. Nass, Fairbanks, Morse & Co., Beloit, Wis. The subject of Mr. Nass' presentation was "Cores and Test Bars." The speaker told of the ways his company have been making test bars for the Navy, the Federal Specifications Board and other government agencies. In dwelling on the Navy specifications for test bars the speaker told of new revisions that had been made and presented a new and interesting method of gating and pouring test bars in the mold. An informative discussion period followed Mr. Nass' talk.

Scrap Situation

With Chapter Vice President Al Gierach, American Manganese Steel Div., presiding, E. G. Howell, J. T. McEnroe Co., addressed the ferrous group following the dinner of the Chicago chapter. Mr. Howell explained the scrap situation from the viewpoint of one who has been providing scrap for foundry uses. He discussed the conditions leading up to the present emergency, governmental control influences and factors of supply. Concerning the moving of old automobile scrap seen in yards throughout the country, Mr. Howell stated that with the demand for repair parts, these old automobiles were the stock in trade of the dealers. His presentation was found very informative to those present and an extensive discussion period brought out additional points in which the members were interested.

Group Meetings Attract Many Ontario Foundrymen

By G. L. White,* Toronto, Ont.

THE first group meeting of the Ontario chapter for the present season was held at the Royal Connaught Hotel, Hamilton, on November 28. Over 100 sat down to dinner at which Chairman N. B. Clarke, Steel Co. of Canada, Ltd., presided. A brief program preceded the division into gray iron, malleable, and non-ferrous groups.

Gray Iron

The gray iron group, under the leadership of Jack Stavert, Babcock-Wilcox & Goldie-McCulloch, Ltd., Galt, heard an excellent paper on "Raw Materials for the Cupola" by G. O. Loach, Otis-Fensom Elevator Co., Ltd., Hamilton.

Mr. Loach discussed the contributions made to cast iron by pig iron, foundry returns and scrap metal, with particular reference to the present situation which is requiring increased consumption of scrap. In the utilization of large proportions of scrap, one of the great difficulties is to secure closely graded materials. Variations in scrap make close supervision of charges necessary to prevent trouble. Certain modifications in foundry practice may be necessary for the utilization of increased quantities of scrap but the attempt should be made to employ scrap with the least possible change in process. With larger proportions of sulphur in charges, more foundries may have to employ desulphurization procedures.

Malleable

The malleable group, under the leadership of R. C. Yates, Canadian Furnace, Ltd., also discussed conservation of pig iron. It was agreed that the three principal possibilities were as follows: (1) use of gray iron scrap in air furnace charges up to from 6-12 per cent; (2) duplex operation, melting first in the cupola and finishing in the air furnace; and (3) production of cupola pig iron by melting approximately 80 per cent steel scrap and 20 per cent gray iron scrap in cupola, pigging it, and using the resulting pig in a portion of the air furnace charge in subsequent production.

An excellent discussion on brittleness of malleable iron by M. E. McKinney, International Harvester Co. of Canada, Ltd., led to the conclusion that if the chemical composition of white iron is silicon over .090, carbon

*Westman Publications, Ltd., and Secretary-Treasurer, Ontario chapter.

under 2.80, manganese 1.7 times sulphur content plus 10 points, phosphorus under 0.20 chromium under 0.025, the cause of embrittlement is probably in the annealing process.

Non-Ferrous

Under the leadership of O. W. Ellis, Ontario Research Foundation, the non-ferrous group considered the recent work on porosity in tin bronzes published by T. F. Pearson and W. A. Baker, British Non-Ferrous Metals Research Association, in the Journal of the Institute of Metals, August, 1941.

Extensive tests were made to determine the influence of shrinkage and of dissolved gases on the incidence of porosity in tin bronze, using a closely controlled melting and casting technique.

Bronzes are prone to dispersed shrinkage unsoundness by reason of the long freezing range of the alloys. They also are prone to unsoundness resulting from the evolution of hydrogen, water vapor, carbon monoxide, and sulphur dioxide, the extent of the gas porosity being much greater for the first mentioned two causes. Carbon dioxide and nitrogen are inert to the alloys. Gas porosity generally takes the same form of shrinkage unsoundness except in grossly unsound castings where the cavities may appear approximately spherical in shape.

Following the discussion on this paper, a problem in the production of leaky castings was brought forward by A. C. Boak, Empire Brass Manufacturing Co., Ltd. The group was unanimous in its opinion that the conditions under which castings had been made, could not account for the troubles that were being experienced until the castings were hydraulically tested. Numerous suggestions were presented for improving the gating of the castings. It was agreed that this was indeed a successful meeting.

Twenty-second Chapter Organized by Toledo Men

THE twenty-second chapter of the A.F.A. was formally organized the evening of December 5, when some seventy A.F.A. members and guests met at the Hillcrest Hotel, Toledo. The meeting was called when a petition signed by members of the district was approved by the Board of Directors which authorized the chapter. R. E. Kennedy, Secretary of the Association, opened the meeting and called for a report of a nominating committee. Those nominated and elected were:

Chairman: V. E. Zang, Steel Casting Div., Unitcast Corp., Toledo

Vice Chairman: W. A. O'Brien, Electric Auto Lite Co., Fostoria

Secretary-Treasurer: R. T. Jansen, Unitcast Corp., Toledo

Directors: C. F. Carson, National Supply Co., Toledo
R. L. Binney, Binney Casting Co., Toledo
W. C. Adler, Ohio Steel Casting Co., Lima
R. A. Clark, Toledo Machine & Tool Div., E. W. Bliss Co., Toledo
L. M. Long, Bunting Brass & Bronze Co., Toledo
L. Brown, Magnesium Fabricators, Adrian, Mich.
W. F. Erler, Modern Pattern Works, Toledo

With the election of officers, the meeting was then turned over to Chairman Zang, who, after introducing the other officers and directors, called upon C. E. Westover, A.F.A. Executive Vice President. Mr. Westover presented to Chairman Zang "to have and to hold" until the next chapter is formed, the celebrated "cast iron baby rattle," decorated with a big blue ribbon. With appropriate remarks, Mr. Westover congratulated the chapter on electing such a good group of officers and directors to lead it through its first year.

After announcing the next meeting for Friday, January 9, at the same place, with Norman J. Dunbeck as the speaker, Mr. Zang again called upon Mr. Westover, who gave an interesting discussion of a method for mounting patterns for short run production orders. Illustrating his talk with slides, he described a method which permitted economy production when only some six or eight castings are to be made from the same pattern.

In the discussion which followed, members present contributed some further good ideas on pattern mounting and other

A splendid turnout of Toledo foundrymen at their organization meeting gave all indications that this new chapter is not going to be "babied" even though it is the newest addition to the Association's family.
(Photo courtesy S. N. Farmer, Sand Products Corp., Cleveland)

devices. Chairman Zang, in closing the meeting, emphasized the general purpose of the future meetings which would be to have a free exchange of ideas on common foundry problems.

Sand Movie Shown at Philadelphia Meeting

By B. H. Bartells,* Philadelphia, Pennsylvania

THE December meeting of the Philadelphia chapter was held on Friday evening, December 12, at the Engineers Club. Dinner was served to approximately one hundred members and guests. Chairman Harry Reitinger, U. S. Pipe & Foundry Co., presided.

The first speaker, Charles Grakelow, Director of Purchases and Supplies for the City of Philadelphia, and a member of the Mayor's Cabinet, was introduced by Lee Harris, Link Belt Co. He gave a very timely and interesting talk on the defense activities and plans in Philadelphia for the present emergency.

The technical session was devoted to "Sand." A color motion picture with sound was presented by Whitehead Bros. Co. The picture shows the origin, preparation of sand and its application in foundries. It is unique as it starts at the very beginning—showing the effect of glaciers and erosion, grinding up materials of the mountains to a fine powder which is washed by melting glaciers into the valleys and streams. Erosion is the agent which produces the grains of sand.

After covering the geological history, many of the natural deposits in our section of the country are shown being mined, graded, processed and shipped. Research is also shown and the application picture stimulates pride in the accomplishments of the American Foundrymen's Association and the foundry industry. It stresses the fact that quantity and quality of castings are of vital importance in our Defense Program today.

A discussion on sand problems followed the showing of the picture, questions being answered by a committee composed of representatives of various sand companies, including: L. Dill, Geo. F. Pettinos Co.; B. Belden, Whitehead Bros. Co.; J. Minser, Taggart & Co.; H. J. Williams, New Jersey Silicon Sand Co.; and H. Mandel, Pennsylvania Foundry & Sand Co.

*University of Pennsylvania, and Reporter, Philadelphia chapter.

Massari Speaks Before New England Foundrymen

By Merton A. Hosmer,* Boston Massachuetts

THE last meeting of the New England Foundrymen's Association for the current year was held at the Engineer's Club, Boston, on December 10. There were eighty members and guests present.

The speaker was S. Massari, metallurgist, Association of Manufacturers of Chilled Car Wheels, Chicago, Ill., and his subject was "Combustion Control in the Cupola."

Mr. Massari gave a very fine address on a subject with which he was most familiar and which proved to be valuable and profitable to all. The author explained that there was a definite relation between the temperature of the fuel and the percentage of it that will burn. As the fuel is burned more efficiently, the greater the loss of manganese and silicon in the charge, so that it is necessary to determine the point where the greatest efficiency is obtained. In one of the charts which was shown, 13½ per cent CO_2 gave the most economical melting where the cost of the coke and the cost of coke plus silicon and manganese loss was figured out.

The speaker showed the advantage of having a CO_2 recorder operating in conjunction with the cupola and said that with this instrument an analysis of the gases every two or two and one-half min. would prove to bring about considerable saving.

*Chemist, Hunt-Spiller Mfg. Co., and Reporter, New England Foundrymen's Association.

Capacity Crowd for Northeastern Ohio Party

WITH "Robbie" Robinson as chairman of the annual dinner party committee, the Northeastern Ohio chapter held this event the evening of December 11 at the Carter Hotel, Cleveland. Notwithstanding the fact that the Carter has the largest space for a dinner gathering in the city, attendance at the dinner could have been several hundred more than the 1000 who were lucky to obtain tickets. Another record breaker checked up to the chapter which has made a reputation over the years with this popular event. Those attending enjoyed a splendid dinner and a most entertaining floor show, as can be seen by the pictures shown below.

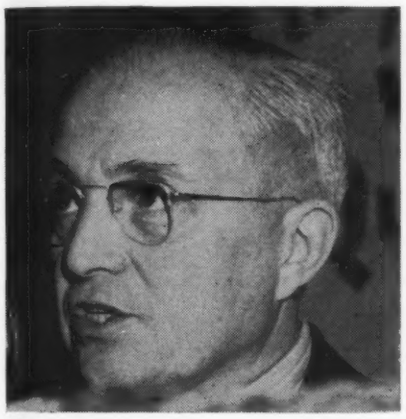
A few of the personalities present at the Northeastern Ohio Chapter Christmas party.
(All photos of Northeastern Ohio Christmas party courtesy S. N. Farmer, Sand Products Corp., Cleveland)

Pontiac Motor Company Host to Detroit Chapter

By O. E. Goudy,* Detroit, Mich.

ON November 27, the Pontiac Motor Car Co., under the direction of O. Allen, foundry superintendent, was host to Detroit chapter's second meeting of the season, and with about 400 present, set an attendance record for Detroit chapter meetings.

A trip through the foundry in groups of about twenty each preceded the dinner and meeting, which was held in the executive dining room.



Z. T. Crittenden, chief plant metallurgist, Pontiac Motor Car Co., addressing the Detroit chapter members at their meeting held in Pontiac.

Following the dinner, O. Allen, acting chairman, introduced S. W. Ostrander, plant manager, Pontiac Motor Car Co., who gave an address of welcome, and told of the activities at their plant, dealing somewhat with the defense operations in their gun plant.

After introducing a number of guests, and a short address by C. E. Westover, Executive Vice President and Treasurer, American Foundrymen's Association, on chapter activities, O. Allen introduced Z. T. Crittenden, chief metallurgist, Pontiac Motor Car Co., who gave the principal address of the evening, covering the subject "Methods of Operation and Control in Pontiac Foundry."

By means of slides, Mr. Crittenden illustrated the various operations performed in the making of cylinder blocks and other automotive castings. Covering the subject of cupola preparation in their plant, he then pictured the manner in which charges are made up and delivered to the cupola. Mr. Crittenden illustrated how each ladle of metal is given a chill test, and this is used as a guide to control ladle additions for the purpose of controlling hardness in the cylinder blocks. After covering the manner in which the cylinder blocks are cooled, Mr. Crittenden covered the sequence of operations that the castings are put through in the cleaning room.

Mr. Crittenden dealt also with the manner in which their materials are received, that is, sand in hopper cars and delivered to storage tanks by means of an elevator, and cupola stone are received on wooden frames, thereby making it possible for one truck operator to unload the stone and also they require less storage space.

Following Mr. Crittenden's discussion, Chapter Chairman V. Crosby, Climax Molybdenum Co., Detroit, introduced Vaughn Reid, City Pattern Works, Detroit, who acted as technical chairman, during which time Mr. Crittenden and others of the Pontiac foundry staff answered many questions relative to their operations. A rising vote of thanks was expressed to Mr. Z. T. Crittenden, Mr. O. Allen, and others of their staff for their many courtesies extended.

*Kelsey Hayes Wheel Co., and Reporter, Detroit chapter.

Pictures taken during the Detroit chapter's inspection trip through the Pontiac Motor's foundry at Pontiac, Mich. Top—(left to right) A.F.A. Director Fred J. Walls, International Nickel Co., Detroit, Mich., A.F.A. Executive Vice President C. E. Westover, Chicago, Ill., and Omer L. Allen, foundry superintendent, Pontiac Motor Car Co., examining a motor block. Center—Omer L. Allen (right) chats with D. R. Wilson, Wilson Foundry, Pontiac. Bottom—(left to right)—Stanley Ostrander, plant manager, charge of automotive production, Omer L. Allen and C. E. Westover seated at the speakers' table.

Two views of Detroit chapter members seated at the dinner tables in the Executives' Dining room of the Pontiac Motor Car Co., following an inspection trip through the Pontiac foundry.

Mechanical Charging, Cupola Operation Subject at Twin City Chapter Meeting

By O. W. Potter,* Minneapolis, Minn.

THE regular monthly meeting of the Twin City chapter was held November 17 at the Midway Club, St. Paul, Minn., with Chapter Chairman E. C. Madson, Anderson Foundry Co., Bayport, Minn., presiding. Approximately 55 members were on hand for this session.

J. Waldman, Federal Bureau of Investigation, Washington, D. C., gave a short but interesting talk on "The Work of the F.B.I." He reported that the crime bill in this country is approximately 15 billion dollars per year. The F.B.I. deals particularly in criminal cases, such as bank robbery, kidnaping, white slavery, espionage and sabotage. Since the start of the present war there has been a great increase in the number of cases of espionage and sabotage as would be expected. Mr. Waldman stated that they now have in their files approximately 78,000 such cases. Most of them are thrown out for the lack of evidence.

The speaker of the evening was A. W. Gregg, Whiting Corp., Harvey, Ill., who spoke on the subject, "Cupola Operation and Mechanical Charging." Mr. Gregg pointed out that one very important factor in the successful operation of any cupola is the careful attention to all the various details of its operation, such as cleaning out and patching, putting in the bottom, lighting up and the burning of the bed, charging and other similar cupola operations. He also pointed out that the cupola tender's job was one of the most important in the whole foundry and a man of intelligence should be picked and paid well for his services. A discussion of different types of mechanical charging installations was given and illustrated with slides showing recent mechanical equipment being installed.

*University of Minnesota, and Secretary-Treasurer, Twin City Chapter.

Many Present at Annual St. Louis Celebration

By J. W. Kelin,* St. Louis, Mo.

THE St. Louis district chapter had the largest and finest Christmas party in its history, Thursday night, December 11.

Nearly 400 foundrymen and friends attended the dinner and party which was held at the De Soto Hotel. Long recognized as the real event of the year, as far as the social phase of St. Louis chapter work is concerned, this one really "topped" all others.

Upon entering the banquet hall, which had been especially decorated for the occasion, the members were greeted by strolling musicians playing any and all favorite numbers. This feature was especially entertaining. Following a period of refreshments and visitation, a fine steak dinner was served.

Entertainment feature of the evening was a floor show over two hours long, entertaining the group in royal fashion.

All in all it was a great evening and a fine tribute to the work done by the entertainment committee chairman, Russell Hard, M. W. Warren Coke Co., and his two assistants, Harold Wiese, Midvale Mining & Mfg. Co., and Bill McKey, Key Co.

*Federated Metals Div., A. S. & R. Co., and Secretary-Treasurer, St. Louis District Chapter.

The Northeastern Ohio Christmas party was enjoyed by all and here are a few pictures to show the good time they had.

Northern California Hears How F.B.I. Works

By G. L. Kennard,* San Francisco, California

THE San Francisco office, Federal Bureau of Investigation, kindly complied with our recent request and assigned H. C. Van Pelt to speak to an attentive group of members and friends at the Lake Merritt Hotel in Oakland, Friday evening, December 5. S. D. Russell, Phoenix Iron Works, Oakland, past chairman, conducted the meeting. Before he presented our speaker he summarized the activities of the chapter's various committees.

*Northern California Foundrymen's Institute, Secretary-Treasurer, Northern California chapter.

The membership drive was highlighted, stressing the importance of contacting every prospect. The programs for future meetings include possibilities of having a visit in February from President H. S. Simpson.

Everyone has at least some vague knowledge of the activities of the Bureau, but after having listened for over an hour to Mr. Van Pelt each one was better informed. We had some of the super-human stunts discredited, and learned that it was the function of the F.B.I. to attend to many of the details which the ordinary citizen takes little or no thought of. Because of world conditions it was quite to the point that our speaker stressed the importance of being on our guard; to take notice of, and immediately report to the F.B.I. office such information as would help them in their business of protecting individual and national safety.

In the light of what happened on December 7 our speaker's message was prophetic and crystalizes the necessity for every American to be on his toes to detect and report everything that tends to undermine our national security.

National Officers Visit Wisconsin Chapter Meeting

By George K. Dreher,* Milwaukee, Wis.

HUNTING season and Thanksgiving celebrations were not enough to hold down the attendance at the November 21 meeting of the Wisconsin chapter, at which 240 members and guests were treated to a complete evening.

Chapter President Art Ziebell, Universal Foundry Co., Oshkosh, introduced National Vice President Duncan Forbes, Gunite Foundries Corp., Rockford, Ill., who told the membership of some of the recent moves of the national organization. He reviewed the activities of the A.F.A. committee on apprentices, cost, and sand research, also advising that a new *Cast Metals Handbook* would be issued in 1943. Vice President Forbes told that the Government has encouraged the A.F.A. to hold an extensive foundry exhibit in 1942, and the national organization will accordingly do so in the third week of April, 1942. An exceptionally large Army Ordnance exposition will be held in conjunction with the Show. This combination should produce the largest foundry display of all times.

Executive Vice President C. E. Westover, Chicago, Ill., also was introduced to the Wisconsin chapter by President Ziebell.

The meeting was then turned over to Bill Hambley, chairman, membership committee, who introduced 32 new members into the goodfellowship of the Wisconsin chapter. Bill Hambley also recorded the fact that the Wisconsin chapter now has 378 members.

A sound film titled "The Design of Steel Castings" was shown through the courtesy of the Steel Founders' Society, Cleveland, Ohio. The meeting then broke up into groups for individual meetings.

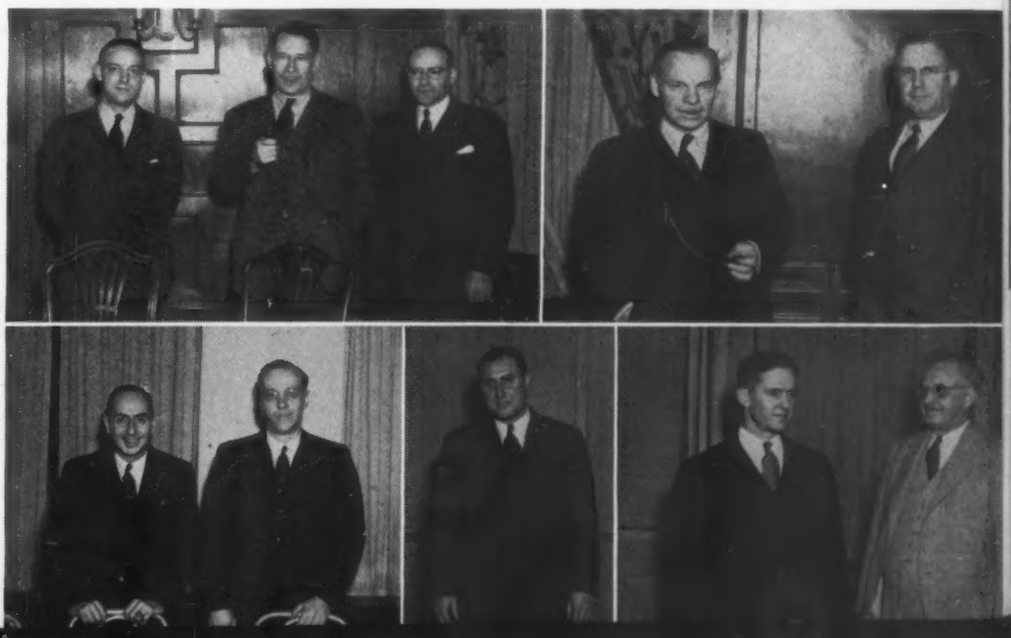
Gray Iron Section

Under the direction of Chairman Frank Kulka, Genl. Supt., Motor Castings Co., Milwaukee, this group heard the very interesting subject of "Engineering Viewpoint on Design of Gray Iron Castings," by R. A. Beckwith, chief engineer, Koehring Co., Milwaukee. The starting point of a desirable and profitable relationship between engineer, foundryman, and patternmaker, three distinct personalities in their own right, each knowing his own profession, was one of the serious problems tackled by Mr. Beckwith. His expression of opinion on use of isometric drawing in conjunction with accepted blueprints, because better conception of a pattern or casting is thereby obtained, met with approval of the large group present.

Malleable Section

Approximately 35 attended this group, with a paper on melting practice being given by J. Arthur Durr, development engineer, Malleable Founders' Society, Cleveland, Ohio, after which he lead the discussion.

Speakers and chairmen of the various groups that participated in the Wisconsin Chapter sectional meeting held in November. Top row—left (left to right): Malleable Chairman J. B. Gutenkunst, Milwaukee Malleable & Gray Iron Co., Milwaukee; the speaker, J. A. Durr, Malleable Founders' Society, Cleveland, and R. J. Anderson, Belle City Malleable Iron Co., Racine. Right (left to right): Gray Iron Chairman Frank Kulka, Motor Castings Co., Milwaukee, and Speaker R. A. Beckwith, Koehring Co., Milwaukee. Bottom row—left (left to right): Non-Ferrous, the speaker, C. V. Nass, Fairbanks, Morse & Co., Beloit, and Chairman Walter Edens, Ampco Metal, Inc., Milwaukee. Center: C. N. Spidell, Chairman, Entertainment Committee, Sand Products Corp., Milwaukee. Right (left to right): B. Koch, The Falk Corp., Milwaukee, and Steel Chairman Fred Pritzlaff, The Falk Corp., Milwaukee.



*Mgr., Ampco Metal, Inc., and Secretary-Treasurer, Wisconsin chapter.

J. B. Gutenkunst, Milwaukee Malleable & Gray Iron Co., Milwaukee, acted as chairman. Mr. Durr described his experience of a pulverized coal melting unit with the burners set at about a ten degree angle instead of the usual twenty-one degree angle. He indicated many advantages that could be gained if such equipment could be revised. This created considerable discussion and Mr. Durr, upon request for copies of his paper, advised that they would be available at a later date.

Non-Ferrous Section

This group devoted the evening to a scrap clinic, led by C. V. Nass of the Fairbanks Morse Co., Beloit, Wis. The chairman was Walter W. Edens, metallurgist, Ampco Metal, Inc., Milwaukee. Mr. Nass briefly discussed the common causes of casting defects occuring in non-ferrous foundry practice. After this discussion, the meeting was thrown open for general discussion. Many problems, some of them concerning castings which had been brought to the meeting, were taken up by the group for suggestions as to proper means of overcoming production difficulties.

Steel Section

"Welding of Steel Castings" was the subject presented by Clinton Swift, welding engineer, Ampco Metals, Inc., Milwaukee. Acting as chairman was Fred Pritzlaff, foundry supt., The Falk Corp., Milwaukee. Various problems encountered in repair welding of carbon and alloy steel castings by the electric arc method were discussed by the speaker. Main topics of his talk were the choice of suitable electrodes, proper welding technique, the advantages of preheating and the desirability of stress relieving after welding. Slides were shown, illustrating the procedure followed in fabricating large units made up of castings and structural members.

President Simpson at Chesapeake Get-Together

By Frederick Bruggman,* Baltimore, Md.

"WERE you there, Charlie? If you were not you missed a real treat. The 200 members and guests who were present will agree that the entertainment committee, headed by L. H. Denton, chapter secretary, Baltimore Association of Commerce, again presented a fine evening of fun and fellowship. The program included a six-act floor show, buffet lunch and refreshments.

We were particularly honored by the presence of National President H. S. Simpson, National Engineering Co., Chicago, Ill., who participated in the executive meeting of the chapter at 6:30 p.m., as well as the social event which followed. Mr. Simpson advised that his contribution to the success of the foundry industry will be to promote a nation-wide campaign to advertise the use of castings by acquainting engineers, and users of castings, with the opportunities they afford. This publicity campaign will be supplemented by a technical movie which will be available for exhibition to organizations, students in engineering schools and various other groups, and will serve as a background in promoting the use of the type of castings that will best serve any particular purpose. A booklet written in language that the layman can understand, describing the use of castings, will be available for distribution with the showing of the picture.

*Gibson & Kirk Co., and Reporter, Chesapeake chapter.

Riggan at Birmingham Talks of Sand Problems

By H. G. Mouat,* Birmingham, Alabama

The regular meeting of the Birmingham District chapter was called to order by Chairman J. A. Bowers, American Cast Iron Pipe Co., Birmingham, Ala., at the Tutwiler Hotel, November 21, 1941. For the dinner, prior to the meeting, 25 members attended. For the regular meeting and technical session 48 members and visitors were present.

Chairman Bowers called attention to the write-ups in various magazines in regard to Mr. Oberhelman. A letter of appreciation to this chapter from Mrs. Oberhelman was read by Vice Chairman J. R. Reynolds, U. S. Pipe & Foundry Co., Bessemer, Ala.

T. H. Benners, T. H. Benners & Co., Birmingham, made a report on the apprentice meetings and the future programs, urging all to attend and support these meetings.

*Sales Engineer, Whiting Corp., and Secretary-Treasurer, Birmingham District chapter.

Pictures taken at the Chesapeake chapter Christmas party.
(Photos courtesy F. Bruggman, Gibson & Kirk Co., Baltimore, Md.)

Report of membership committee was made by A. S. Holberg, Alabama Clay Products Co., Birmingham. Twenty-three new applications were reported. The names of these new members were read by Chairman Bowers. Mr. Bowers complimented the work of this committee.

The meeting was then turned over to W. H. Spencer, Thomas Foundries, Inc., Birmingham, who introduced the speaker for this evening, Fred B. Riggan, Key Co., St. Louis, Mo. Mr. Riggan gave an excellent talk, with slides, and led a general discussion on sand control, mixes, and general foundry practice. Several questions were asked and well answered, and the program was participated in by many members.

Hoenicke on Permanent Molds Before Michiana

WITH Chapter Chairman Ed Bumke, Oliver Farm Equipment Co., presiding at the regular monthly meeting of the Michiana chapter, Hotel La Salle, South Bend, E. C. Hoenicke, Eaton Erb Div., Eaton Mfg. Co., Detroit, gave a most enlightening illustrated description of the making of permanent mold gray iron castings. Mr. Hoenicke described the pioneering work necessary to develop equipment to obtain the full possibilities of the process. A striking feature of the castings made by this method was emphasized, namely, that the castings are uniform throughout, with test bars cut from any section showing equal density and strength. This feature is obtained by what is called a self-forging phenomena where the pressure exerted when graphitizing occurs is resisted by the metal mold and produces the dense structure. Examples of castings adaptable to the process were exhibited. Another interesting point brought out was that in several cases castings were produced which gave better results than steel forgings which the castings replaced.

Following the chapter dinner, V. C. Bruce, Buckeye Products Co., chairman, chapter membership committee, reported on new member possibilities. Wm. Bachman, New York Central Railroad, discussed the chapter's co-

E. C. Hoenicke Addressing Members of Michiana Chapter.
(Photo Courtesy L. N. Tucker, City Pattern Works, South Bend, Ind.)

operation with the national Cupola Research Committee. R. E. Kennedy, A.F.A. Secretary, and N. F. Hindle, A.F.A. Assistant Secretary, also were present.

Movie Films Shown at Central Indiana Meeting

By R. A. Thompson,* Indianapolis, Indiana

A GROUP of 75 Central Indiana foundrymen gathered at the Washington Hotel, Monday, December 1, to see two movies presented by the Illinois Clay Products Co., Chicago, Ill., and the A. P. Green Fire Brick Co., Mexico, Mo. Chapter Chairman H. B. Harvey, Indiana Foundry Co., Muncie, Ind., presided. B. P. Mulcahy, Citizens Gas & Coke Utility, Indianapolis, introduced the representatives of the two companies when they presented their movie. Robert Langsenkamp, Langsenkamp-Wheeler Brass Works, Indianapolis, acted as the discussion leader.

The first picture to be shown was "The Operation of a Clay Plant." This is a sound movie made by the Illinois Clay Products Co., and Fred Hintze, a representative of the company, said a few words concerning the film.

"A Trip Through the A. P. Green Fire Brick Company" was the second film run and W. G. Twyman, a company representative, discussed the picture while it was being shown.

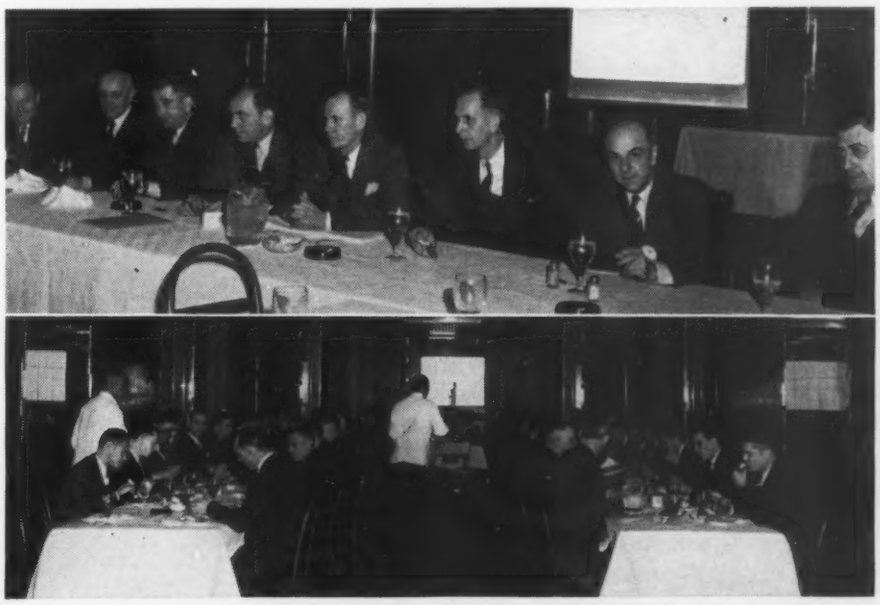
*Electric Steel Castings Co., and Secretary, Central Indiana chapter.

Southern California Discusses Defense Orders

By Earl Anderson,* Los Angeles, California

THE Southern California chapter held a well attended meeting at Scully's Restaurant on Tuesday evening, November 18. B. George Emmett, Los Angeles Steel Casting Co., chapter president, presided.

*Enterprise Iron Works, and Vice President, Southern California chapter.



Michiana chapter pictures taken at the December meeting.
(Photos courtesy L. N. Tucker, City Pattern Works, South Bend, Ind.)

Southern California chapter officials at the November meeting. Sitting at the speaker's table are (left to right) H. R. Washburn, Los Angeles Herald Express, speaker; Chapter President B. George Emmett, Los Angeles Steel Casting Co., and Chapter Vice-President Earl Anderson, Enterprise Iron Works. The bronze bell in front of President Emmett is the membership bell they received last year for finishing second in the membership drive.

Approximately 130 foundrymen and guests turned out to hear a talk given by H. R. Washburne, "The Los Angeles Herald Express," on the subject "How to Procure Defense Orders." He spoke at length on priority procedure and defense contracts and urged the necessity of changing civilian production into National Defense manufacturing. The talk was very interesting and instructive and everyone present received some valuable advice. Many questions were asked, followed by a lively discussion which lasted way beyond the usual closing time.

The program closed with a motion picture showing defense preparations in the United States.

Powder Metallurgy Talk at Western Michigan

By Max Amos,* Muskegon, Mich.

R. H. KHUEN, Amplex Division, Chrysler Corp., Detroit, Mich., presented an interesting and informative talk before 125 foundrymen gathered at the Ferry Hotel, Grand Haven, Monday, December 1, for their regular monthly meeting. D. F. Seyferth, West Michigan Steel Foundry Co., Muskegon, Mich., acted as presiding officer.

"Powder Metallurgy" was the topic of Mr. Khuen's address and he presented data on the origin of the idea, importance of the industry at present in connection with the defense program, and prospects for improvement of the art in the future. The talk was well illustrated with parts produced by the Amplex Division. A lengthy discussion period followed the author's presentation.

*Standard Automotive Parts Co., and Secretary-Treasurer, Western Michigan chapter.

Lecture Course News From Other Chapters

THE educational course for apprentices and foundrymen of the Chicago district will get under way Tuesday evening, 7:30 o'clock, January 13, at the Peoples Gas, Light & Coke Co. auditorium, 122 S. Michigan. The lecture course program is under the direction of L. F. Lottier, Peoples Gas, Light & Coke Co.

Twelve sessions have been planned, to run from January through April. The first three meetings are scheduled for January 13, 20 and 27. The lectures this year have been planned in such a manner that a study can be made of the casting from raw material used to the finished product. For the committee to plan this it has been decided that the 1942 course will be an introduction to the extended course whereby a more detailed study can be made. This year's course is divided into five parts —Castings in Industry, 2 lectures; Raw Materials for Castings, 3 lectures; Blue Print

A packed house at the Northeastern Ohio Chapter's Christmas party is very much in evidence as shown in these pictures.

John P. Kelly (left) talking with George Street at a recent Philadelphia chapter meeting.
(Photo courtesy W. B. Coleman, W. B. Coleman & Co., Philadelphia, Pa.)

Reading and Elementary Drawing, 2 lectures; Patterns and Pattern Design, 3 lectures; and Castings Clinic, 2 lectures.

From Birmingham, where their lecture courses have been in operation since November, comes word from Chairman T. H. Benners, Jr., T. H. Benners & Co., that the courses are well attended and a great amount of interest shown. The December 12 meeting of the course had H. H. Farr, Sanitary Pipe Co., Alexander City, Ala., for a speaker and he discussed "Pattern Design and Its Effect on Foundry Production." The door prize was won by J. Henley, American Cast Iron Pipe Co., Birmingham, Ala.

Foundry Students at Minnesota Hold Meeting

By Sidney S. Silberg,*
Minneapolis, Minn.

ON Wednesday, November 26, the foundry students at Minnesota University held a dinner meeting on the campus in accordance with the program that they have set forth. This group holds one meeting per month at which they have a speaker. At the November meeting Nathan Levinsohn, foundry metallurgist, Minneapolis Moline Power Implement Co., was the guest speaker and he presented an informative and interesting lecture.

Also on the program was Carl Magnuson, senior mechanical engineer, who reported on conditions and procedures that he found in one of the Twin City brass foundries which he visited.

*University of Minnesota, and Secretary, University of Minnesota Student Chapter.

Cupola Information Presented by Roueche

By T. H. Benners,*
Birmingham, Ala.

THE November 28 meeting of the Birmingham chapter lecture course was one of the best of the series as W. Lee Roueche, McWane Cast Iron Pipe Co., Birmingham, Ala., lectured on "Cupola and Cupola Operation." The talk was given from a paper prepared by the author and caused so much favorable comment that the committee has decided to mimeograph and distribute the paper at one of the meetings in the near future.

*T. H. Benners & Co., and Chairman Birmingham Apprentice Training Course.

Northeastern Ohio Sends Pledge to Government

By Edwin Bremer*, Cleveland, O.

AS USUAL attendance at the Northeastern Ohio Chapter's annual Christmas stag party held on December 11 was limited by the dinner seating capacity of the Rainbow Room, Carter hotel, Cleveland, which is the largest of its kind in the city. However, 1,000 members and guests were present and enjoyed an excellent turkey dinner which was followed by a topnotch floor show arranged under the direction of L. P. Robinson, chairman of the entertainment committee.

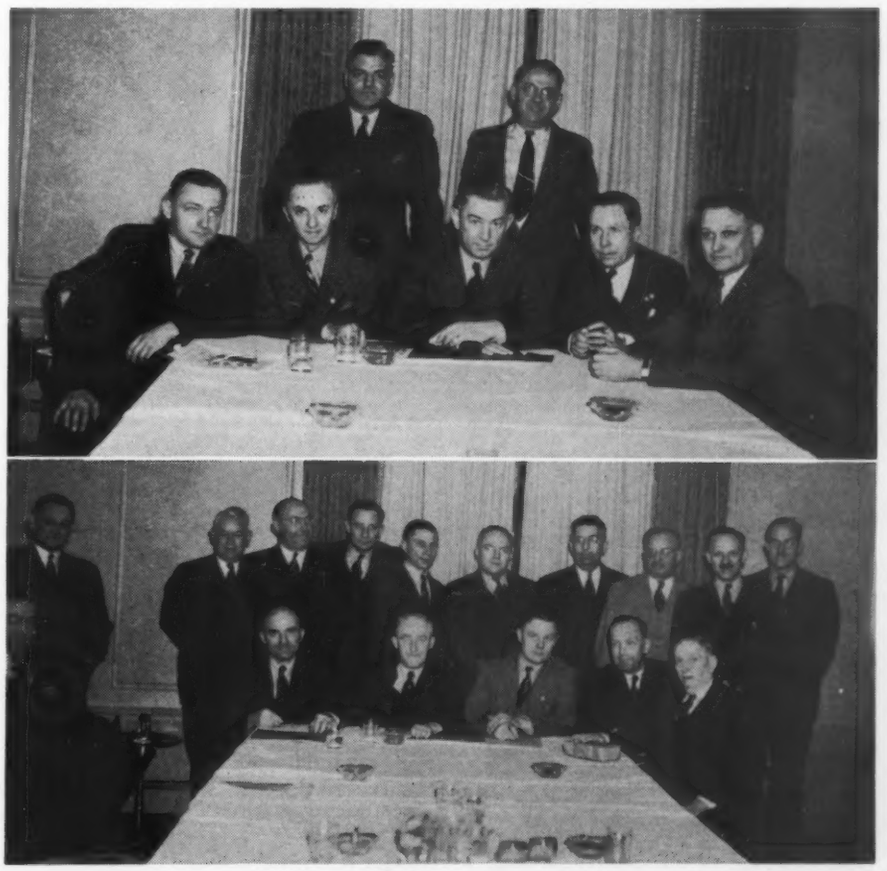
Feature of the meeting was the dispatching of a telegram voicing the sentiment of all present. It was as follows:

Donald M. Nelson,
Director SPAB,
New Social Security Bldg.,
Washington, D. C.

We, one thousand foundrymen attending the December meeting in Cleveland, pledge our wholehearted support and cooperation to you, SPAB and the government of the United States in our "all out" war effort with the Axis powers. We will "Remember Pearl Harbor."

(Signed)
Northeastern Ohio Chapter
of the American Foundrymen's Association.

*Metallurgical Editor, The Foundry, and Chairman, Publicity Committee, Northeastern Ohio Chapter.



Members of the Wisconsin regional conference committee are working hard to see that their meeting will be a tremendous success. Here are two pictures showing members of the committee.
(Photo courtesy John Bing, A. P. Green Fire Brick Co., Milwaukee, Wis.)

Abstracts

NOTE: The following references to articles dealing with the many phases of the foundry industry, have been prepared by the staff of *American Foundryman*, from current technical and trade publications.

When copies of the complete articles are desired, photostat copies may be obtained from the Engineering Societies Library, 29 W. 39th Street, New York, N. Y.

Casting

BOMB SHELLS. *"Cast Bomb Shells in Canadian Plant,"* by Pat Dwyer, *The Foundry*, vol. 69, No. 12, December, 1941, pp. 50-53, 133-136. The program of this shop is based on constant movement of molds, cores and castings, in the general direction of the final inspection and shipping dock. The only temporary delay in the forward movement is where a group of molds is assembled on a roller conveyor between heats from two electric furnaces that do the melting. Furnaces are arranged to tap in turn after each other and deliver about 10,500 lb. of steel, enough to pour seven molds, or 28 shells at each heat. About one-half of the building is devoted to cleaning, machining, testing, storing and shipping the shell castings. The foundry proper takes up the rest of the building with the shake-out and sand preparation at one end and the electric furnaces at the other. Steel for the shells conforms to the following approximate analysis: carbon 0.25 per cent, silicon 0.40 per cent, manganese 0.70 per cent, sulphur 0.05 per cent and phosphorus 0.05 per cent. Metal enters the mold through a single sprue in the center of the cope, terminating in a well at the bottom in the drag half of the mold and feeding into a gate in the form of a cross with branch leading to each shell unit in the mold. A single modest size riser on top of the pointed end of the shell serves as a feeder. (Ca.)

SAND CASTINGS. *"Magnesium Sand Castings,* by N. M. Briskin, *The Metal Industry* (London), vol. 50, No. 10, September 5, 1941, pp. 150-151. Proper gating is one of the greatest problems the foundryman has to face in making magnesium castings. Theories of gating used in ferrous metals can seldom be directly applied because of the peculiar properties of magnesium alloys: (1) because of its low specific gravity and lightness, dirt and sand will not float on iron or steel and (2) because of the low specific heat and low latent heat of fusion, castings of magnesium solidify very rapidly. Cast iron chills are useful in heavy sections, as in general foundry practice, to rapidly solidify metal in these sections and prevent shrinkage. Chills also are useful in thin sections of magnesium castings which are difficult to feed properly. In all heat-treating of magnesium alloys, accurate temperature control is essential, as melting of the eutectic must be avoided. The heat treatment given consists of heating to the solution temperature, which varies from 330°C. to 430°C., depending on the alloy composition, holding for about 12 hr., and then air-cooling. (Al.)

Cast Iron

MANGANESE. *"Manganese in Gray Cast Iron,"* by Dr. J. T. MacKenzie, *Pig Iron Rough Notes,* No. 86, Autumn, 1941, pp. 5-8. Manganese in the foundry takes care of sulphur and oxygen. The author reviews a paper written by himself for A.F.A. in which he gives pertinent data on manganese additions. Figures show that if there is not enough manganese to take care of the sulphur and oxygen hardness, chill and brittleness increase very rapidly; strength drops; and troubles from blow holes, shrinkage, and misruns appear. A fairly safe manganese for ordinary conditions is 0.3 per cent plus 1.7 sulphur. Manganese is the only constituent that shows high melting loss at both ends of the melting conditions. If melted cold it oxidizes faster than any other constituent and when melted hot it is lost by actual volatilization. (C.I.)

QUALITIES. *"Qualities of Gray Cast Iron,"* by H. L. Campbell, *The Iron Age,* vol. 148, No. 19, November 6, 1941, pp. 66-68. As a rule, the quality of cast iron is based on the tensile strength of the metal when cast in bars of a definite size and turned to specimens having definite dimensions. The chief factors that influence the properties of cast iron in the condition as cast are chemical composition and the rate of cooling from the molten state. One of the most significant characteristics of gray cast iron is shown in the change of properties resulting from different rates of cooling. A further discussion of specifications is presented along with a graph illustrating the effect of the size of separately cast round bars of cast iron on the tensile strengths of specimens turned from these bars. In making tensile tests of gray cast iron, it is very important that the loads on the specimens be applied only in tension, as any forces in transverse directions will lower the breaking loads. (C.I.)

STRESS-STRAIN. *"Stress-Strain Diagram of Malleable Cast Iron,"* by H. A. Schwartz and C. H. Junge, *A.S.T.M. Bulletin,* No. 112, October, 1941, p. 22. Concerning the work of the authors on Young's modulus of elasticity presented at the 1941 meeting of A.S.T.M. it appeared well to investigate the form of the complete stress-strain curve. Since the modules of elasticity cannot be satisfactorily determined on unmachined specimens, it seemed desirable for purposes of comparison to use mechanical specimens for the preparation of this curve also even though an unmachined specimen is customarily used for acceptance testing. In that connection it was occasionally noted that the stress-strain curve had a somewhat unusual form as shown in Fig. 1. The curves *A, B* and *C* of this figure are identical save for the scale used for strain. In about three-eighths of the cases observed there is a slight inflection which might almost be interpreted as a yield point. (Ma.)

Chills

INTERNAL. *"Internal Chills Used in Small Steel Castings,"* by C. E. Westover, *The Foundry,* vol. 69, No. 12, December,

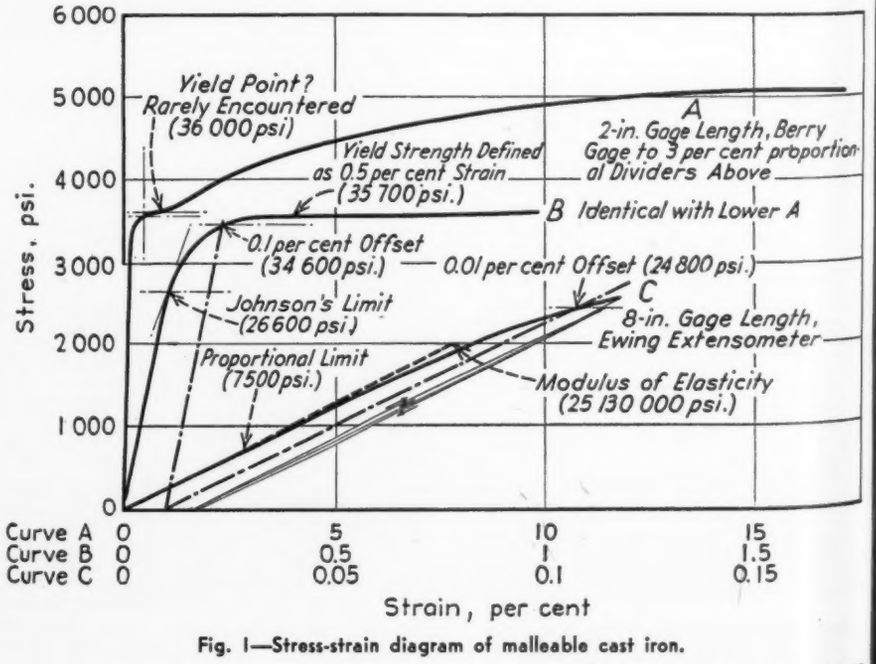

6 000
5 000
4 000
3 000
2 000
1 000
0
Stress, psi.
Yield Point? Rarely Encountered (36 000 psi)
Yield Strength Defined as 0.5 per cent Strain (35 700 psi.)
A
2-in. Gage Length, Berry Gage to 3 per cent proportional Dividers Above
B Identical with Lower A
0.1 per cent Offset (34 600 psi.)
0.01 per cent Offset (24 800 psi.)
Johnson's Limit (26 600 psi.)
C
8-in. Gage Length, Ewing Extensometer
Proportional Limit (7500 psi.)
Modulus of Elasticity (25 130 000 psi.)
Curve A 0 5 10 15
Curve B 0 0.5 1 1.5
Curve C 0 0.05 0.1 0.15
Strain, per cent

Fig. 1—Stress-strain diagram of malleable cast iron.

1941, pp. 60-61, 145-150. This is a study of the use of internal chills and their place in the production of small steel castings. A review of the many articles concerning the use of chills in steel castings is presented and then the author emphasizes the importance of the shape of design of chills plus their placement and position in the mold. The numerous photographs used in this paper illustrate in what type of casting chills can be used and the author explains in detail how they were employed to obtain the best results. (S.)

Heat Treatment

ALUMINUM ALLOYS. *"Radiant Tube Furnace for Heat Treating Aluminum Alloys,"* by E. A. Schmeller, *Metals and Alloys,* vol. 14, No. 3, September, 1941, pp. 295-300. There are several types of furnaces in which aluminum alloy castings can be heat treated, they include fuel fired, direct or indirect; electric; salt bath and numerous others. The selection of one of these furnaces depends and is affected by local conditions, types of castings that must be heat treated and cost. The National Bronze and Aluminum Foundry Co., Cleveland, Ohio, chose a radiant tube type for certain products it produces. The two reasons influencing the selection of such a furnace were the cost of operation and necessity of heat treating certain castings not directly heated by the products of combustion. This paper describes the new type of radiant tube furnace, as well as the heat treatment applied. (H.T.)

STEEL. *"The Heat Treatment of the Chromium-Carbon Stainless Steels,"* by W. E. Mahin and W. C. Troy, *A.S.M. Preprint No. 34,* 1941, pp. 1-36. A high purity hydrogen-nitrogen inert atmosphere has been used for heat treatment of the hardenable 12 per cent chromium steels with freedom from the usual oxide films. Advantage is taken of the "air hardening" characteristics of the steel, and close hardness control is obtained through control of the carbon content of martensite. The carbon in martensite is dependent upon carbon content of the steel (above the A_3 point) in the hypoeutectoid steels, but only upon quenching temperature in the hypereutectoid steels. Tempering treatments are used only for control of residual stresses. A small methane addition to the atmosphere was found to provide surface hardness above Rockwell 60C for applications where maximum wear resistance and toughness are required. A number of interesting applications for the martensitic stainless steels are pointed out. Among these, frequent use was made of simultaneous furnace brazing and hardening. (S.)

Nickel

CONSTITUENTS. *"Major Constituents of Nickel Silver,"* by C. R. Draper, *The Metal Industry* (London), vol. 48, No. 23, June 6, 1941, pp. 482-484. The effect, on the physical properties, casting, and working of nickel silvers, of variation in the content of the three major constituents, nickel, copper and zinc, is reviewed in this article. Nickel is the most important constituent of the nickel silvers and is responsible for their high corrosion resistance and much of the attracive color. Zinc plays its part by blueing the color, making it a better white and, more particularly, by improving mechanical properties. (Ni.)

COPPER. *"On High Conductivity and High Strength Copper Alloys,"* by Dr. Masazo Okamoto, *Japan Nickel Review,* vol. 9, No. 3, July, 1941, pp. 168-184. Copper is extensively used as an electrical conductor in the two forms of the pure metal and high strength alloys. Only the age hardenable complex copper alloys possess high conductivity and high strength, and in order to obtain these properties the alloy elements should be precipitated as a separate phase in an almost pure copper matrix after the alloys are quenched and tempered. The principal alloys that fulfill these conditions and at the same time have good properties are alloys of iron-nickel-phosphorus-copper; nickel-phosphorus-copper; nickel-silicon-copper; nickel-cobalt-silicon-copper; cobalt-silicon-copper; nickel-beryllium-copper; cobalt-beryllium-copper; and nickel-phosphorus-beryllium-copper. From these facts it is apparent that the presence of nickel is very important in the age hardenable copper alloys with high conductivity. Of the alloy systems mentioned, the nickel-beryllium-copper alloys seem to be the best in view of their excellent age-hardening property and high electrical conductivity. (N.F.)

Steel

DETERMINING CARBON CONTENT. *"Magnetic Methods for Determining Carbon in Steel,"* by B. A. Rodgers, K. Whetzel and J. P. Riott, *A.S.M. Preprint No. 11,* 1941, pp. 1-18. Consideration was given to five magnetic properties of steel that seemed likely to vary with carbon content in a definite manner—saturation, permeability, coercive force, remanence and hysteresis loss. The first two were investigated, and the results obtained are reported in some detail. The usefulness of the third had been described previously, but additional studies were made. The last two were not investigated as they did not appear to have any advantage over the other properties. The experiments showed that magnetic saturation and carbon content could be accurately correlated between the limits of about 0.50 per cent carbon and some undetermined point above 1.10 per cent, but that below 0.50 per cent that saturation-carbon content curve had a slope too small to be satisfactory. A new apparatus employing alternating current was used to measure permeability; by means of a rectifier the values were indicated as a steady deflection on a direct-current meter. With this equipment two types of heat treatment were required; samples containing more than 0.40 per cent carbon were quenched from above the critical range, whereas those with less were kept in the mold until they were below the critical range. When both types of heat treatment were used, samples ranging from below 0.10 per cent to some value above 1.10 per cent carbon could be tested in the apparatus. A brief description is given of a simplified apparatus for determining carbon content from measurements of coercive force. (S.)

FLUIDITY. *"Measuring the Fluidity of Cast Steel,"* by H. F. Taylor and E. A. Rominski, *The Iron Age,* vol. 148, No. 22, Nov. 27, 1941, pp. 40-44. A test mold employing a spiral flow channel is described which can be used satisfactorily for measuring the fluidity (castability) of steel in the furnace prior to tapping or in the ladle on the pouring floor. Advantages resulting from the use of this test for measuring the fluidity of the steel made in the 3-phase, electric-arc furnace at the Naval Research Laboratory are described. It is possible to follow changes in the castability of steel brought about by deoxidizers and alloying elements or by variations in temperature or in furnace practice. The technique for obtaining such information is described. (S.)

HARDENING. *"The Hardening of Steel,"* by Robert F. Mehl, *Metal Progress,* vol. 40, No. 5, November, 1941, pp. 759-765. This paper was presented as the 16th Edward deMille Campbell Memorial lecture. The highlight of the paper and the study is the results achieved by the electron microscope on transparent replicas of the surface conditions existing on polished and etched steel samples. Light also is shed on the true action of furnace practice, deoxidation methods, and grain refiners, on the mechanism of hardening and the hardenability of our commercial steels. It appears that variations in hardenability are brought about first by variations in grain size, as this is determined by deoxidation practice, affecting the rate of nucleation; second, by variations in composition—deliberate or accidental—affecting both the rate of nucleation and the rate of growth; and third, by inadequate carbide solution, affecting the rate of nucleation. (S.)

HEAT TREATMENT. *"Fundamental Features of Controlled Atmospheres, Particularly for the Heat Treatment of Steel,"* by H. W. Gillett and B. W. Gonser, *A.S.M. Preprint No. 31,* 1941, pp. 1-8. Most failures when using controlled atmospheres in heat treating steel are due to disregard of the fundamental principles which are outlined in this paper. Of particular importance in preventing decarburization is the removal of moisture and prevention of its formation in the furnace by reaction of CO_2 and H_2. The lower the temperature and shorter the time of treatment, the less care need be taken on obtaining a non-reactive atmosphere. Furnace atmospheres for non-ferrous alloys and alloy steels are briefly discussed, but greatest emphasis is placed on means for obtaining a gas mixture in true equilibrium with steel and which will stay that way on heating. (S.)

ISOTHERMAL TRANSFORMATION. *"Kinetics and Reaction Products of the Isothermal Transformation of a 6 Per Cent Tungsten 6 Per Cent Molybdenum High Speed Steel,"* by J. L. Ham, R. M. Parke and A. J. Herzig, *Transactions,* American Society of Metals, vol. 29, No. 3, September, 1941, pp. 623-637. The S-curve of a 6 per cent tungsten-6 per cent molybdenum high speed steel was determined by dilatometric, hardness and metallographic tests. The practical significance of the results is discussed briefly. (S.)

LOW ALLOY CASTINGS. *"Low Alloy Steel Castings,"* by C. H. Lorig, *Metals and Alloys,* vol. 14, No. 5, November, 1941, pp. 712-717. This paper summarizes work that has been done for several years in the production of a group of low alloy steel castings, somewhat analogous to the low alloy, high strength wrought steels, which have been widely discussed and are extensively used. Very little has been published on these low alloy steel castings, though some survey has been made of this group. In general the steels in regular production are the medium manganese, the low nickel, the Ni-Mn, the Ni-Cr, the Ni-Cr-Mo, the Ni-Mo and the Ni-V as described in the table of this article. There also is a special titanium steel quite in favor. (S.)

MELTING. *"The Manufacture of High-Quality, Low Cost Steel,"* by P. J. McKimm, *Steel,* vol. 109, No. 13, September 29, 1941, pp. 78, 80-82, 90. Reduction in the time required for charging open-hearth furnaces is possible only by suitable mixing and preparation of the scrap. Charging molten iron is simple and speedy; scrap must be properly selected in order to secure the most economical charging cost. The relation between the cost of scrap per ton of ingots and the cost of charging per ton of ingots should be studied. (S.)

MORTAR SHELLS. *"Cast Steel Mortar Shells,"* by E. Bremer, *The Foundry,* vol. 69, No. 11, November, 1941, pp. 50-55, 124, 126. The firm in this article is producing 60 mm. mortar shells for the Army, and a somewhat larger 3-in. mortar shell for the British. The 60 mm. shell is made of low carbon cast steel and receives a 15 hour heat treatment while the British shell is made from a medium carbon steel which receives a 9 hour heat treatment. Steel is melted in electric furnaces. Raw material is comprised of 30 to 40 per cent return sprue and gates and 60 to 70 per cent low carbon plate scrap with a small amount of ore. The heats melt down with 0.16 to 0.18 per cent carbon and extremely low silicon and are brought to the proper analysis; carbon being picked up from ferromanganese or by additions of pig iron. Steel is melted and poured continuously during the two-shift or 16 hour day. Before pouring from the small furnaces nearly all slag covering the bath is removed, leaving a nearly bare metal surface. About halfway through the heat the slag again is skimmed off. Tapping is done at about 3000°F., and on pouring ranges from 2850°F. to 2900F. Quality of the steel is under careful control at all times. From one to three preliminary carbons are run on the heats, and of these at least one determination is made by the laboratory, and the others by an electrical device called a carbanalyzer, which is located on the furnace door. Test samples are taken after pouring is begun, on the second ladle, the fifteenth, the thirteenth and last ladles. Once each day on each furnace determinations are made for sulphur, phosphorus and chromium contents of the steel. On heats for Army ordnance shells two keel blocks are poured from the fifteenth and thirtieth ladles and from those same ladles a mold is tagged for identification. Shell molds are made on a battery of 10 molding machines arranged in a line along an overhead mold conveyor. From the storage bins the sand is brought to the right moisture content, which ranges between 2 to 3 per cent and the bond up to 3½ per cent. Permeability ranges from 212 to 226. American shells are mounted in two rows of 6, or 12 on a plate. British shells are mounted 8 on a plate in two groups of four. Facing for the English shell is comprised of all new silica sand with an A.F.A. grain fineness of 48 to 52, to which 70 lb. of bentonite has been added per 3000 lb. of sand. Facing sand for our shells is composed of half heap molding sand and half new silica sand. Heat treating is done in two continuous type, electrically heated ovens equipped with controlled atmosphere apparatus. After heat treating the shells are cleaned inside and out by abrasive blasting, using steel grit. Following the cleaning the ends of the shells are clipped square. A pictorial review shows many of these operations as performed at this plant. (S.)

NITROGEN. *"The Role of Nitrogen in 18-8 Stainless Steel,"* by H. H. Uhlig, *A.S.M. Preprint No. 23,* 1941, pp. 1-35. Pure 18-8 alloy quenched from 1150°C. (2100°F.) is ferritic, not austenitic, at room temperature. Nitrogen, which is accidentally present in the commercial alloy, is found to inhibit the gamma to alpha phase transformation occurring on cooling at about 100°C. (210°F.) Properties of the two lattice structures of 18-8 are presented. Magnetic behavior, yield strength, hardness, thermal and electrical conductivities, and coefficient of expansion show the greatest differences for the body centered compared with the face centered cubic structure. The corrosion resistance of the two structures, annealed sufficiently, does not differ appreciably. Evidence is presented that ferritic 18-8 is magnetically anisotropic. Nitrogen, under certain conditions, readily diffuses into or out of 18-8, thereby converting the alloy to either structure. (S.)

NITROGEN. *"Nitrogen for Nickel in Cr-Ni Steels,"* by W. Tofaute and H. Schottky, *The Iron Age,* vol. 148, No. 20, Nov. 13, 1941, pp. 39-43. A practically pure austenitic structure can be produced by nitrogen and the limited addition of nickel in Cr-steels containing less than 0.1 per cent C. In the alloy with 0.05 per cent C and 23 Cr at about 4 per cent Ni and 0.25 N_2 a sufficiently stable austenite was obtained to outlast annealing as well as cold deformation. These nickel-saving nitrogen-bearing Cr-steels are technologically remarkable by their high yield point and high degree of deformability, as shown by results achieved with sheets and rods. They combine the advantages of the martensite-troosite steels with those of the austenitic Cr-Ni steels, and also are suited for deep drawing. Weldability and strength heat treatment are very good. Hot work offers no particular difficulties. Stability in oxidizing acids and chloride solutions is equal to or better than that of 18 and 8 steels. No tendency was noted toward intercrystalline corrosion. (S.)

OPEN-HEARTH BOTTOMS. *"Basic Open-Hearth Furnace Bottoms,"* by C. R. Austin, *Industrial Heating,* vol. 8, No. 10, October, 1941, pp. 1158, 1160, 1162. This is a review of some improved designs for furnace bottoms as used in open-hearth furnaces. Some of the newer furnace bottoms are insulated with a layer or layers of insulating brick between the fire-clay brick and the metal pan. Such brick must have good resistance to load at elevated temperatures. The use of a plastic chrome ore mix above the chrome brick in the bottom with a consequent decrease in the thickness of the sintered magnesite hearth is finding increasing use. There has been a tendency in recent years to reduce the thickness of the dead-burned magnesite hearth by increasing the thickness of the basic brick work beneath the hearth. A rammed sub-hearth of a magnesitic ramming refractory, usually 6-in. thick, also is coming into use. This is installed in the furnace prior to the actual "burning-in" of the bottom. The Crespi dolomite bottom has aroused much interest in the last year. This process is covered by U. S. Patent No. 2,206,277. One of the main innovations in this process is the lack of a bonding material. (F.)

OPEN-HEARTH PROCESS. *"Controlling Reactions in the Open-Hearth Process,"* by B. M. Larsen, *Transactions,* A.I.M.E., vol. 145, 1941, pp. 67-83. This paper aims to present, and to justify, the viewpoint that the most significant reaction is the oxidation of carbon in the metal, the progress of which determines the oxygen pressure levels in slag and metal and produces stirring effects, all of which influence the course of the process as a whole. The general "working theory" of the open-hearth bath system with the carbon reaction acting as the important fundamental control factor in the working period of the heat has certain logical consequences for the process control. The so-called "control of iron oxide in slag" is considered to have little significance to actual operating control, as the iron oxide in the slag is a secondary rather than a primary factor. The essential fundamental variables become: bath temperature, oreing rate, charge composition and slag basicity. The slag basicity becomes an independent variable, which can be controlled entirely from the point of view of operating convenience and efficiency plus the attainment of requisite (S) and (P) contents. Certain secondary variables such as slag viscosity, bath depth, speed of working, etc., tend to be reduced in importance with respect to FeO levels in the steel and therefore may be controlled, at least within certain reasonable limits, entirely from the point of view of operating convenience and economy. (S.)

OUTPUT. *"The Output of Steel Castings,"* by E. F. Cone, *Metals and Alloys,* vol. 14, No. 3, September, 1941, pp. 316-317. A presentation of statistics concerning the steel foundry industry for 1940 and previous years. This article briefly summarizes the steel situation and a table shows the approximate production of the industry as a whole. The table covers the last four years. A feature is the rather unexpected fact that 1937 has been the best year of the four despite the expanding operations of the steel industry as a whole in 1940. (S.)

PROCESSES. *"Research Problems Relating to Steelmaking Processes," Transactions,* A.I.M.E., vol. 145, pp. 59-66. This report contains a list of problems relating to the physical chemistry of steelmaking and has been prepared by the committee on the Physical Chemistry of Steelmaking, from answers to a questionnaire submitted to a number of metallurgists engaged in both educational and industrial work throughout the United States. The list includes the study of properties, and their correlation, as well as the physical and chemical reactions, of all substances that occur or that may be in any way associated with steelmaking operations, such as metallic substances, refractories, nonmetallic inclusions, and the constituents of slags. (S.)

STRAIN HARDNESS. *"Quantitative Measurement of Strain Hardness in Austenitic Manganese Steel,"* by D. Niconoff, *Transactions,* American Society of Metals, vol. 29, No. 2, June, 1941, pp. 519-540. The strain hardening properties of austenitic manganese steel were determined by subjecting it to impact of different intensities and measuring the surface hardness as well as the depth of its penetration. The maximum strain hardness of approximately Rockwell C-50 was found to be located not at the surface, but a short distance below it. Further down, the strain hardening effect gradually decreased until it disappeared completely. Under repeated impacts, this maximum strain hardness could be increased only slightly. With still greater number of the impacts delivered against already hardened surface of

manganese steel, the hardness of the outer layers was observed to have actually decreased somewhat; but the depth of penetration of the strain hardness under such conditions was increased. It also was found that unexpectedly high work input was required for fully strain hardening austenitic manganese steel. (S.)

See Historical, Iron and Steel

STRUCTURES. *"Transformation Structures of Some Forty Carbon Steels," Metals and Alloys,* vol. 14, No. 3, September, 1941, pp. 318-325. Photomicrographs of certain plain carbon, carbon-molybdenum, Cr-Mo (4140) and Ni-Cr-Mo (4340) steels show the structure at various transformation temperatures. In a forthcoming revision of its book on molybdenum in steel, the Climax Molybdenum Co. will publish further researches from its laboratory in Detroit, giving the results of expanded work in this field. This discussion on transformation structures covers microstructures. (S.)

See Heat Treatment, Steel

Strain

See Cast Iron, Stress-Strain

Testing

MOLYBDENUM. *"Simplified Molybdenum Determination,"* by George M. Poole, *The Iron Age,* vol. 48, No. 15, October 9, 1941, pp. 62, 164-165. Molybdenum steels, particularly those of in the higher molybdenum percentages, are assuming an increasing importance in the defense program. Herein is described a very accurate and simplified procedure for molybdenum determinations in such alloy steels—it is a modification of the James method, using the Cenco-Sheard-Sanford photelometer. (Te.)

January Chapter Meeting Schedule

January 5

Central Indiana
Washington Hotel, Indianapolis
CHAS W. JONES, Wm. H. Block Co.
"Personnel Relations"

✦

Metropolitan
Essex House, Newark, N. J.
D. FRANK O'CONNOR, Walworth Co.
"Non-Ferrous Pressure Castings"

✦

Western Michigan
Occidental Hotel, Muskegon
E. E. WOODLIFF, H. W. Dietert Co.
"Molding Sand Problems"
WM. ROMANOFF, H. Kramer & Co.
"Non-Ferrous Foundry Practices"

✦ ✦

January 8

Northeastern Ohio
Cleveland Club, Cleveland
"Equipment Night"

✦

St. Louis District
DeSoto Hotel
Round Table—Steel: D. B. REEDER, Electro Metallurgical Co.
"Melting of Steel in Electric Furnace and Open Hearth"
Gray Iron: JOHN L. LOWE, Battelle Memorial Institute
"Cupola Practice"
Non-Ferrous: E. D. MOONEY, Federated Metals Co.

✦ ✦

January 9

Philadelphia
Engineers Club
D. FRANK O'CONNOR, Walworth Co.
"Non-Ferrous Night"

✦

Central New York
Onondaga Hotel, Syracuse
G. A. PEALER, Elmira Foundry Co., Elmira
"Patternmaking"

✦

Toledo
Hotel Hillcrest
N. J. DUNBECK, Eastern Clay Products, Inc.
"Synthetic Sand"

✦ ✦

January 10

Northern California
Alexander Hamilton Hotel, San Francisco
R. E. BROWN, Electro Metallurgical Sales Corp.
"Usage of Ladle Additions of Alloys in Gray Iron Production"

✦ ✦

January 12

Chicago
Top of the Town Restaurant
THOMAS NELSON, Dale Carnegie Course Corp.
"Human Relations"

January 13

Michiana
Hotel La Salle, South Bend
WM. ROMANOFF, H. Kramer & Co.
"Brass Foundry Practice"
T. E. BARLOW, Vanadium Corp of America
"Alloy Cast Iron"

✦ ✦

January 14

New England Foundrymen's Association
Hotel Gardiner, Boston
"Annual Meeting"

✦ ✦

January 15

Detroit
Packard Motor Car Co. Administration Building
F. O. CARPENTER, Packard Motor Car Co.
"Special Techniques for Automotive Castings"

✦ ✦

January 16

Wisconsin
Hotel Schroeder, Milwaukee
Sectional Meetings
Gray Iron
F. A. PAMPLE, Chain Belt Co.
"Cost of Material Handling Good Housekeeping"
Malleable
E. A. ZIRZOW, National Malleable & Steel Castings Co.
"Practicability and Cost of Natural Bonded Molding Sand vs. Synthetic Sand"
Steel—Cores
PAUL C. POWER, Maynard Electric Steel Casting Co.
Molding
CHAS. FUERST, Falk Corp.
"Sand Mixtures"
Non-Ferrous
A. M. FISCHER, Chas. Jurack Co.
"Patterns for the Jobbing Foundry"

✦

Birmingham District
Tutwiler Hotel
"Quiz Program"

✦ ✦

January 19

Quad City
Ft. Armstrong Hotel, Rock Island
C. E. WESTOVER, Executive Vice President, American Foundrymen's Assn.
"Steel Castings"
"Activities of A.F.A."

Twin City
Coffman Memorial Union, University of Minnesota, Minneapolis
DR. GEO. A. THIEL, University of Minnesota
"Molding Sands"
Moving Pictures
Illinois Clay Products Co.

✦ ✦

January 23

Chesapeake
Engineers Club, Baltimore
Round Table Discussion—
Steel—J. E. CROWN, Naval Gun Factory
Gray Iron—R. T. COVINGTON, American Hammered Piston Ring Co.
Non-Ferrous—E. W. HORLEBEIN, The Gibson & Kirk Co.

✦ ✦

January 30

Ontario
Royal Connaught Hotel, Hamilton
J. JONES, Great Lakes Sand Co.
"Sand Control in the Foundry"

✦ ✦

Regional Conferences

February 19 and 20

Tenth Annual Foundry Practice Conference
Sponsored by Birmingham District Chapter

✦ ✦

February 26 and 27

Fifth Annual Regional Foundry Conference
Sponsored by Wisconsin Chapter and University of Wisconsin

✦ ✦

March 7

New England Foundrymen's Association
Sixth New England Foundry Conference
Massachusetts Institute Technology, Cambridge, Mass.
Sponsored by New England Foundrymen's Association
With the Co-operation of M.I.T. and A.F.A.

✦ ✦

March 28

University of Pennsylvania, Philadelphia
Sponsored by Chesapeake, Metropolitan and Philadelphia Chapters

✦ ✦

Apprentice Meetings

Birmingham Chapter
Tutwiler Hotel
January 9
January 23

✦

Chicago Chapter
Peoples Gas Light & Coke Co., Auditorium
January 13
January 20
January 27

Announcing the

1ST WESTERN HEMISPHERE FOUNDRY CONGRESS

On November 25 the Board of Directors of the American Foundrymen's Association was asked to consider staging, in conjunction with the 46th Annual Convention, a Western Hemisphere Foundry Congress. By letter ballot this was unanimously approved and letters were immediately prepared in the Spanish and Portuguese languages for mailing to South and Central American countries inviting participation in a program to promote Hemisphere Solidarity and Common Defense.

Before announcement was released to the foundrymen of South, Central and North America our government was attacked and war declared. The program now becomes, as in the first World War, an ALL-OUT Contribution of the Foundry Industry to increased production of WAR MATERIALS.

The theme of the Congress, Convention and Show in Cleveland next April will be a Demonstration of the Industry's Contribution to, and support of our President's pledges of COMPLETE VICTORY.

FOUNDRY and ALLIED INDUSTRIES SHOW } *Cleveland,* APRIL 18, 20 - 24, 1942